DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Scheme of Instruction

and

Syllabi of

M.Tech(Parallel And Distributed Systems)

2017-2018

UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMOUS)

OSMANIA UNIVERSITY

HYDERABAD – 500 007, TELANGANA
# SCHEME OF INSTRUCTION
## M.TECH (PARALLEL AND DISTRIBUTED SYSTEMS)
Proposed from the Academic year 2017-18

## SEMESTER - I

<table>
<thead>
<tr>
<th>S.No</th>
<th>Course Code</th>
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## SEMESTER - II

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**SCHEME OF INSTRUCTION**  
**M.TECH (PARALLEL AND DISTRIBUTED SYSTEMS)**  
Proposed from the Academic year 2016-17

### SEMESTER III

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**Project Seminar Evaluation:** 50 marks to be awarded by Supervisor and 50 marks to be awarded by Viva-Voce committee comprising Head, Supervisor and an Examiner.

### SEMESTER – IV

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<th>S. No</th>
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**Note:** Six Core subjects, Six Elective subjects, Two Laboratory Courses and Two Seminars must be offered in Semester I and II.
# List of Core Subjects:

<table>
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<tr>
<td>1</td>
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<td>2</td>
<td>CS 5202</td>
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*List of Elective Subjects:

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<td>2</td>
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<td>3</td>
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<td>4</td>
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<td>CS 5256</td>
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<td>CS 5304</td>
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<td>28</td>
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Distributed Algorithms

Credits: 3

Instruction: 3L hrs per week  Duration of SEE: 3 hours

CIE: 30 Marks  SEE: 70 Marks

UNIT-I


Leader Election in a Synchronous Ring: The Problem, Impossibility Result for Identical Processes, A Basic algorithm, An algorithm with $O(n \log n)$ communication Complexity, Non-Comparison-Based Algorithms, Lower Bound for Comparison-Based algorithms, Lower-Bound for Non-Comparison-Based algorithms.


UNIT-II

Distributed Consensus with Process Failures: The Problem, algorithms for Stopping Failures, Algorithms for Byzantine Failures, Number of processes for Byzantine Agreement, Byzantine Agreement in General Graphs, Weak Byzantine Agreement, Number of Rounds with Stopping Failures.


UNIT-III


UNIT-IV


**Resource Allocation:** The Problem, Nonexistence of symmetric Dining Philosophers Algorithm, Right-Left Dining Philosophers Algorithm, Randomized Dining Philosophers Algorithm.

UNIT-V

**Consensus:** The Problem, Agreement Using Read/Write Shared Memory, Agreement Using Read-Modify-Write Shared Memory, Other Types of Shared Memory, commutability in Asynchronous Shared Memory Systems.

**Atomic Objects:** Definitions and Basic Results, Implementing Read-Modify-Write Atomic Objects in Terms, atomic Snapshots of Shared Memory, Read/Write Atomic Objects.

**Suggested Reading:**


Parallel Computer Architecture

Credits: 3

Instruction : 3L hrs per week
Duration of SEE : 3 hours

CIE : 30 Marks
SEE : 70 Marks

UNIT I

Instruction Level Parallelism: Concepts and challenges, Instruction Pipeline Design, Hardware and software approaches, Dynamic scheduling, Speculation, Compiler techniques for exposing ILP, Branch Handling Techniques.

UNIT-II

Advanced Processor Technologies: CISC and RISC Architectures, Superscalar Processors, and VLIW Architectures.

Memory Hierarchy Design: Cache basics and Cache performance, Reducing miss rate and Miss penalty, Multilevel cache hierarchies, Main memory organizations, and Design of Memory Hierarchies.

UNIT-III

Parallel Computer Models: Classification of Parallel Computers, Multiprocessors and Multicomputer, and Multi-vector and SIMD computers.

Shared Memory Multiprocessors: Cache Coherence, Memory Consistency, Snoopy-based Cache coherence protocols – Write-Invalidate protocols (MSI, MESI, MOESI), and Write-update protocols.

UNIT-IV


UNIT -V

**Interconnection Network Design:** Basic Definitions, Basic Communication Performance, Organizational Structure, Interconnection Topologies, Routing, Switch Design, and Flow Control.

**Latency Tolerance:** Overview of Latency Tolerance, Latency Tolerance in Explicit Message Passing, Latency Tolerance in a Shared Address Space - Block Data Transfer, Proceeding Past Long-Latency Events, Pre communication in a Shared Address Space, and Multithreading.

**Suggested Reading:**

Web Services

Credits: 3

Instruction: 3L hrs per week

Duration of SEE: 3 hours

CIE: 30 Marks

SEE: 70 Marks

UNIT-I

SOA and Web Services Fundamentals: Introducing SOA, The Evolution of SOA, Web Services and Primitive SOA.

UNIT-II


UNIT-III


UNIT-TV

Building SOA (Planning and Analysis): SOA Delivery Strategies, Service-Oriented Analysis (Part I: Introduction), Service-Oriented Analysis (Part II: Service Modeling).

UNIT-V


Suggested Reading:


Distributed Computing

Credits: 3

Instruction : 3L hrs per week
Duration of SEE : 3 hours

CIE : 30 Marks
SEE : 70 Marks

UNIT I

Introduction: Definition of Distributed Systems, Goals: Connecting Users and Resources, Transparency, Openness, Scalability, Hardware


UNIT II


Remote Procedure Call: Basic RPC Operation, Parameter Passing, Extended RPC Models, Remote Object Invocation: Distributed Objects, Binding a Client to an Object; Static verses Dynamic Remote Method Invocations, Parameter Passing, Message Oriented


UNIT III


Software Agents: Software Agents in Distributed Systems, Agent Technology,

Naming: Naming Entities, Names, Identifiers, and Address, Name Resolution, The Implementation of a Name System, Locating Mobile Entities: Naming verses Locating Entities, Simple Solutions, Home-Based Approaches, and Hierarchical Approaches.
UNIT -IV


UNIT-V

**Distributed Multimedia Systems:** Introduction, Characteristics of Multimedia Data, Quality of Service Management, Quality of Service negotiation, Admission Control, Resource Management Resource Scheduling.

**Suggested Readings:**


Parallel Programming

Credits: 3

**Instruction**: 3L hrs per week  
**Duration of SEE**: 3 hours  
**CIE**: 30 Marks  
**SEE**: 70 Marks

**UNIT - I**


**UNIT - II**

**Communication Operations** - One-to-All Broadcast and All-to-one Reduction, All-to-all Broadcast and Reduction, All-Reduce and Prefix-sum Operations, All-to-all Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.

**UNIT - III**


**UNIT - IV**

**Introduction to Parallel Programming**: Introduction to Parallel Programming, Introduction to OpenCL, OpenCL Device Architectures, Basic OpenCL Examples, Parallel programming using OpenCL/C++ AMP/CUDA.

**UNIT - V**

**Introduction to OpenCL**: Understanding OpenCL’s Concurrency and Execution Model, Dissecting a CPU/GPU OpenCL Implementation.
Suggested Reading:

Grid Computing

Credits: 3

Instruction: 3L hrs per week  Duration of SEE: 3 hours

CIE: 30 Marks  SEE: 70 Marks

UNIT-I


Job Submission: Introduction, Globus Job Submission. Transferring Files.

UNIT-II


UNIT-III


System Infrastructure II: Grid Computing Services: Grid Computing and Standardization Bodies, Interacting Grid Computing Components, Open Grid Services Architecture (OGSA), WSRF.


UNIT-IV


UNIT-V

Case Studies: Globus—Overview of Globus Toolkit 4, Installation of Globus, GT4 Configuration, Main Components and programming Model using Globus.

gLite: Introduction, Internal Workings of gLite, Logging and Bookkeeping (LB), Security Mechanism Using gLite, Resource management using Gridway and Gridbus Scheduling using Condor, SGE, PBS, LSF Grid scheduling with QoS.
Suggested Reading:

CS 5221

Software Lab-I

Credit: 2

Instruction: (3L) hrs per week
CIE: 50 marks


I. Implement the following using C/C++:
   1. Single Source Shortest Path algorithms
   2. All pairs shortest path algorithms
   3. Minimal Spanning Tree algorithms
   4. String and Pattern matching algorithms
   5. Maximum Flow/ Minimum cut algorithms
   6. Binary Search Tree- insertion and deletion
   7. AVL trees

II. Object Oriented Software Engineering

   1. As a case study select any two projects and do the following:
      a) Write the problem statement, Software Requirement Specification, entity relationship diagram,
      b) dataflow diagrams for level 0 and level 1,
      c) Draw use-case diagram
      d) Draw the activity diagram of all use cases.
      e) Draw sequence diagram of all use cases
      f) Draw collaboration diagram of all use cases, and Assign objects in Sequence diagram to classes and make class diagrams

Suggested Reading:


Note: The students have to submit a report at the end of the semester.
CS 5222

With effect from the Academic year 2017-2018

SEMINAR - I
Credits: 2

*Instruction:* (3L) hrs per week

*CIE:* 50 marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his/her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Organization of material
- Preparation of Power point Presentation slides
- Technical writing

**Each student is required to**

1. Submit one page of synopsis of the seminar talk two days before for display on notice board.
2. Give 20 minutes presentation through MS-PowerPoint Presentation Slides followed by 10 minutes discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week of the last week of the semester and any change in schedule should be discouraged.

The CIE marks will be awarded to the students by at least 2 faculty members on the basis of oral presentation and report as well as their involvement in the discussion.
SOFTWARE LAB – II
Credits: 2

Instruction: (3L) hrs per week
CIE: 50 marks

DISTRIBUTED COMPUTING:

1. Design a Distributed Application using RMI for remote computation
2. Design a Distributed Application using Message passing Interface for remote computation
3. Design a Distributed application which consist of a server and client using threads
4. Design a Distributed application which consist of a stateless server using socket primitives.
5. Installation & Configuration of Hadoop.
6. Using Hadoop for counting word frequency with Map Reduce.
7. Write a Map Reduce Application which processes a log file of a system. List out the users
   Who have logged for max period on the system. Use sample Log file from the internet and
   process it using a pseudo distribution mode on Hadoop platform.

Advanced Databases: An application involving above technologies and database has to be
developed

Note: The students have to submit a report using LateX at the end of the semester.
SEMINAR –II

Credits: 2

Instruction: (3L) hrs per week

CIE: 50 marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his/her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members.

Students are to be exposed to the following aspects of seminar presentation.

- Literature Survey
- Organization of material
- Preparation of Power point Presentation slides and Technical Writing.

Each Student is required to:

1. Submit one page of synopsis of the seminar talk two days before for display on notice board.
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3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminar are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The CIE marks will be awarded to the students by at least 2 faculty members on the basis of oral and a written presentation as well as their involvement in the discussion.
CS 5051

With effect from the Academic year 2017-2018

Mobile Computing

Credits: 3

Instruction : 3L hrs per week

Duration of SEE : 3 hours

CIE : 30 Marks

SEE : 70 Marks

UNIT-I


UNIT-II

Telecommunication Systems: GSM, GPRS, Satellite Networks, Basics, Parameters and Configurations, Capacity Allocation, FAMA and DAMA, Broadcast Systems, DAB, DVB, CDMA and 3G.

UNIT-III


UNIT-IV


Mobile IP - Dynamic Host Configuration Protocol.

Traditional TCP - Classical TCP Improvements – WAP, WAP 2.0.
UNIT-V

**Publishing & Accessing Data in Air:** Pull and Push Based Data Delivery models, Data Dissemination by Broadcast, Broadcast Disks, Directory Service in Air, Energy Efficient Indexing scheme for Push Based Data Delivery.

**File System Support for Mobility:** Distributed File Sharing for Mobility support, Coda and other Storage Manager for Mobility Support.

**Mobile Transaction and Commerce:** Models for Mobile Transaction, Kangaroo and Joey transactions, Team Transaction, Recovery Model for Mobile Transactions, Electronic Payment and Protocols for Mobile Commerce.

**Suggested Reading:**

Real Time Systems

Credits: 3

Instruction: 3L hrs per week  
Duration of SEE: 3 hours

CIE: 30 Marks  
SEE: 70 Marks

UNIT-I


UNIT-II

Real Time Scheduling: Different Approaches - Clock Driven, Priority Driven, Scheduling of Periodic and Sporadic Jobs in Priority-Driven Systems.

UNIT-III


UNIT-IV


UNIT-V

Case Studies: Vx – Works, and RT Linux.

Suggested Reading:

CS 5053          With effect from the Academic year 2017-2018

Web Engineering

Credits: 3

Instruction : 3L hrs per week            Duration of SEE : 3 hours
CIE : 30 Marks                        SEE : 70 Marks

UNIT-I


UNIT-II


UNIT-III


UNIT-IV

Web Resource Management: Models and Techniques, Ontology Supported Web Content Management, Design Principles and Applications of XRML.

UNIT-V


Suggested Reading:

CS 5054

Multimedia Technologies

Credits: 3

Instruction: 3L hrs per week

Duration of SEE: 3 hours

CIE: 30 Marks

SEE: 70 Marks

UNIT-I

Media and Data Streams: Properties of multimedia systems, Data streams characteristics:
Digital representation of audio, numeric instruments digital interface Bark concepts, Devices,
Messages, Timing Standards Speech generation, analysis and transmission.

UNIT-II

Digital Image: Analysis, recognition, transmission, Video: Representation, Digitalization
transmission Animations: Basic concepts, animation languages, animations control transmission

UNIT-III

Data Compression Standards: JPEG, H-261, MPEG DVI

Optical storage devices and Standards: WORHS, CDDA, CDROM, CDWO, CDMO.

Real Time Multimedia, Multimedia file System.

UNIT-IV

Multimedia Communication System: Collaborative computing session management, transport
subsystem, QOS, resource management.

Multimedia Databases: Characteristics, data structures, operation, integration in a database
model. A Synchronization: Issues, presentation requirements, reference to multimedia
synchronization, MHEG

UNIT-V

Multimedia Application: Media preparation, Composition, integration communication, consumption, entertainment.

Suggested Reading:

1. Ralf Steninmetz, Klara Hahrstedt, Multimedia: Computing, Communication and Applications,
   PHI PTR Innovative Technology Series.
Data Mining

Credits: 3

Instruction: 3L hrs per week
Duration of SEE: 3 hours

CIE: 30 Marks
SEE: 70 Marks

UNIT-I

Introduction: Why Data Mining? What is Data Mining? What kinds of data can be mined? What kinds of patterns can be mined? Which technologies are used? Which kinds of applications are targeted? Major issues in Data Mining. Getting to know your data: Data objects and attributed types. Basic statistical descriptions of data. Data visualization, Measuring data similarity and dissimilarity.

UNIT-II

Mining frequent patterns, Associations and correlations, Basic concepts and methods, Basic concepts, Frequent Item set Mining Methods, Which patterns are interesting? Pattern evaluation methods.

UNIT-III

Classification: Basic concepts, Decision tree induction, Bayes classification methods,
Classification: Advance methods, Bayesian Belief Network, Classification by back propagation, Support vector machine,

UNIT-IV

Cluster Analysis: Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of clustering.

UNIT-V

Data Mining Trends and Research Frontiers, Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining trends.

Suggested Reading:

1. Jiawei Han, Micheline Kamber, Jin Pei, Data Mining: Concepts & Techniques, Morgan Koffman, 3rd Edition, 2011.
CS 5056

With effect from the Academic year 2017-2018

Network Security

Credits: 3

Instruction : 3L hrs per week  Duration of SEE : 3 hours

CIE : 30 Marks  SEE : 70 Marks

UNIT-I


UNIT-II

Secret Key Cryptography: DES, Triple DES, AES, Key distribution, Attacks

Public Key Cryptography: RSA, ECC, Key Exchange (Diffie-Hellman), Java Cryptography Extensions, Attacks

UNIT-III

Integrity, Authentication and Non-Repudiation: Hash Function (MD5, SHA5), Message Authentication Code (MAC), Digital Signature (RSA, DSA Signatures), Biometric Authentication.

UNIT-IV

PKI Interface: Digital Certificates, Certifying Authorities, POP Key Interface, System Security using Firewalls and VPN's.

Smart Cards: Application Security using Smart Cards, Zero Knowledge Protocols and their use in Smart Cards, Attacks on Smart Cards

UNIT-V

Applications: Kerberos, Web Security Protocols (SSL), IPSec, Electronic Payments, E-cash, Secure Electronic Transaction (SET), Micro Payments, Case Studies of Enterprise Security (.NET and J2EE)
Suggested Reading:

Machine Learning

Credits: 3

Instruction: 3L hrs per week
Duration of SEE: 3 hours

CIE: 30 Marks
SEE: 70 Marks

UNIT-I

Introduction: Learning, Types of Machine Learning.
Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.
Learning with Trees: Constructing Decision Trees, CART, Classification Example

UNIT-II

Linear Discriminants: The Perceptron, Linear Separability, Linear Regression
Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back Propagation SUPPORT Vector Machines: Optimal Separation, Kernels

UNIT-III


UNIT-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming
Ensemble learning: Boosting, Bagging

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis
UNIT-V

**Clustering:** Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison

**Suggested Reading:**

CS 5058

Information Retrieval Systems

Credits: 3

Instruction: 3L hrs per week

Duration of SEE: 3 hours

CIE: 30 Marks

SEE: 70 Marks

UNIT-I

Boolean Retrieval: An example information, Building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: Document delineation and character sequence decoding, determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings, and Phrase queries.

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction.

Index Construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes.

UNIT-II

Index Compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, and Variant tf-idf functions.

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.


UNIT-III

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.


Language models for information retrieval: Language models, The query likelihood model.

UNIT-IV


Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k- nearest neighbor, Linear versus nonlinear classifiers.

Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means.

Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

UNIT-V


Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling.

Web crawling and Indexes: Overview, Crawling, Distributing indexes, Connectivity servers.

Link analysis: The Web as a graph, Page Rank, Hubs and Authorities.

Suggested Reading:

Natural Language Processing

Credits: 3

Instruction: 3L hrs per week  Duration of SEE: 3 hours
CIE: 30 Marks  SEE: 70 Marks

UNIT-I
Introduction of Elementary Probability Theory, Essential Information Theory

UNIT-II
Linguistic Essentials Corpus-Based Work Collocations.

UNIT-III


Word Sense Disambiguation: Methodological Preliminaries, Supervised and unsupervised learning, Pseudo words, Upper and lower bounds on performance, Supervised Disambiguation, Bayesian classification.

UNIT-IV


UNIT-V


Suggested Reading:

Software Quality and Testing

Credits: 3

Instruction : 3L hrs per week

Duration of SEE : 3 hours

CIE : 30 Marks

SEE : 70 Marks

UNIT - I


UNIT - II

Integrating Quality Activities in the Project Life Cycle, Assuring the Quality of Software Maintenance Components, CASE Tools and their effect on Software Quality, Procedure and Work Instructions, Supporting Quality Devices, Configuration Management, Documentation Control, Project Progress Control.

UNIT - III


UNIT - IV


UNIT - V

Suggested Reading:


Web Resources:

4. [java-source.net/open-source/testing-tools](http://java-source.net/open-source/testing-tools)
5. [www.junit.org](http://www.junit.org)
6. [java-source.net/open-source/web-testing-tools](http://java-source.net/open-source/web-testing-tools)
Cloud Computing

Credits: 3

Instruction: 3L hrs per week Duration of SEE: 3 hours

CIE: 30 Marks SEE: 70 Marks

Unit-I

Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning

Unit -II

Scaling in the Cloud, Capacity Planning, Load Balancing, File System and Storage,

Unit-III


Unit-IV

Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services

Unit- V


Suggested reading:


Soft Computing

Credits: 3

Instruction: 3L hrs per week

Duration of SEE: 3 hours

CIE: 30 Marks

SEE: 70 Marks

UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V

Suggested Reading:

Artificial Neural Networks

Credits: 3

Instruction: 3L hrs per week  Duration of SEE: 3 hours
CIE: 30 Marks  SEE: 70 Marks

Unit-I

Background to ANN: Introduction to artificial neural networks (ANN), intelligence, learning and knowledge. Historical development of Artificial Intelligence (AI) leading to ANN. PDP models -- Interactive and competition (IAC) and Constraint Satisfaction (CS) models.

Unit-II

Basics of ANN: Basics of ANN, terminology, models of neurons, topology, basic learning laws, activation and synaptic dynamics models

Unit-III

Analysis of Feedforward Neural Networks (FFNN): Overview, linear associative networks, perceptron network, multilayer perceptron, gradient descent methods, backpropagation learning

Unit-IV

Analysis of Feedback Neural Networks (FBNN): Overview, Hopfield model, capacity, energy analysis, state transition diagrams, stochastic networks, Boltzmann-Gibbs Law, simulated annealing, Boltzmann machine

Unit-V

Applications of ANN: Travelling salesman problem, image smoothing, speech recognition and texture classification.

Suggested Reading:

1. B Yegnanarayana, Artificial Neural Networks, Prentice-Hall of India, New Delhi, 1999


Software Project Management

Credits: 3

Instruction : 3L hrs per week  
Duration of SEE : 3 hours

CIE : 30 Marks  
SEE : 70 Marks

UNIT-I


UNIT-II

Life – Cycle phases, Artifacts of the process, Model Based Software Architectures, Workflows of the Process, Checkpoints of the process.

UNIT-III


UNIT-IV

Modern Project profiles, Next Generation Software Economics, Modern process Transitions, Managing Contacts, Managing People & Organizing Terms.

UNIT-V

Process improvement & mapping to the CMM, ISO 12207 – an overview, programme management.

Suggested Reading:

Image Processing

Credits: 3

Instruction: 3L hrs per week

Duration of SEE: 3 hours

CIE: 30 Marks

SEE: 70 Marks

UNIT I

Image Processing: Introduction, Examples, Fundamental steps, Components, Elements of visual perception, Light and Electromagnetic Spectrum, Image sensing and Acquisition, Image Sampling and Quantization, Basic relationships between pixels.

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Combining Spatial Enhancement Methods.

UNIT II


Image Restoration: Noise Models, Restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering.


UNIT III


UNIT IV

**Image Compression:** Fundamentals, Image Compression Models, Elements of Information Theory, Error-free Compression, Lossy Compression, Image Compression Standards, Some Basic Compression Methods.

**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Some Basic Gray-Scale Morphological Algorithms.

UNIT V

**Image Segmentation:** Fundamentals, Point, Line and Edge Detection, Thresholding, Region-based Segmentation, Segmentation using Morphological Watersheds, The use of Motion in Segmentation.

**Object Recognition:** Patterns and Pattern Classes, Recognition based on Decision-theoretic Methods, Structural Methods.

**Suggested Reading:**


Software Reuse Techniques

Credits: 3

Instruction : 3L hrs per week  Duration of SEE : 3 hours

CIE : 30 Marks  SEE : 70 Marks

UNIT-I
Software Reuse Success Factors, Reuse Driven Software Engineering Business, Object Oriented Software Engineering, Applications and Component Subsystem, Use case Components, Object Components

UNIT-II

UNIT-III
Structural Patterns: Adapter, Bridge, Composite, Decorator, Facade, Flyweight, Proxy.
Behavioral Patterns: Chain of Responsibility, Command, Interpreter.

UNIT-IV
Behavioral Patterns: Iterator, Mediator, Momento, Observer, State, Strategy, Template, Visitor, Other Design Pattern: Whole Part, Master-Slave, View Handler-receiver, Client-Dispatcher-Server, Publisher-Subscriber.

UNIT-V
Architectural Patterns: Layers, Pipes and Filters, Black Board, Broker, Model View Controller.
Presentation: Abstraction-Control, Micro Kernet, Reflection.
Suggested Reading:

CS 5067

With effect from the Academic year 2017-2018

Reliability and Fault Tolerance

Credits: 3

Instruction : 3L hrs per week

Duration of SEE : 3 hours

CIE : 30 Marks

SEE : 70 Marks

UNIT-I

Introduction to Reliability Engineering: Reliability, Repairable and Non-repairable Systems, Maintainability and Availability, Designing, Reliability, Repairable and Non-repairable Systems, MTBF MTBF, MTTF MDT, k out of in systems.

UNIT-II


UNIT-III

Software Reliability Modeling: Introduction to Software Reliability Modeling, Parameter Determination and Estimation, Model Selection, Markovian Models, Finite and Infinite failure category Models, Comparison of Models, Calendar Time Modeling.

UNIT-IV


UNIT-V


Suggested Reading:

Web Mining

Credits: 3

Instruction: 3L hrs per week
Duration of SEE: 3 hours

CIE: 30 Marks
SEE: 70 Marks

UNIT-I

Introduction: The World Wide Web, History of the Web and the Internet, Web Data Mining

Association Rules and Sequential Patterns: Basic Concepts, Apriori Algorithm, Data Formats for Association Rule Mining, Mining with Multiple Minimum Supports, Mining Class Association Rules

Supervised Learning: Basic Concepts, Decision Tree Induction, Classifier Evaluation, Naïve Bayesian Classification, Naïve Bayesian Text Classification, K-Nearest Neighbor Learning, Ensemble of Classifiers

UNIT-II

Unsupervised Learning: Basic Concepts. K-means Clustering, Representation of Clusters, Hierarchical Clustering, Distance Functions, Data Standardization, Handling of Mixed Attributes, Which Clustering Algorithm to Use? Cluster Evaluation

Information Retrieval and Web Search: Basic Concepts, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing, Inverted Index and Its Compression

UNIT-III

Information Retrieval and Web Search: Web Search, Meta-Search: Combining Multiple Rankings, Web Spamming

Link Analysis: Social Network Analysis, Co-Citation and Bibliographic Coupling, PageRank, HITS, Community Discovery

UNIT-IV

Web Crawling: A Basic Crawler Algorithm, Implementation Issues, Universal Crawlers, Focused Crawlers, Topical Crawlers, Evaluation, Crawler Ethics and Conflicts
**Structured Data Extraction:** Wrapper Generation, Preliminaries, Wrapper Induction, Instance-Based Wrapper Learning, Automatic Wrapper Generation, String Matching and Tree Matching, Multiple Alignment, Building DOM Trees, Extraction based on a single list page, extraction based on a single list page: Nested doda records, Extraction based on multiple pages, Some other issues.

**Information Integration:** Introduction to Schema Matching, Pre-Processing for Schema Matching, Schema-Level Match, Domain and Instance-Level Matching, Combining Similarities, 1: Match, Some other issues, Integration of Web Query Interfaces, Constructing a Unified Global Query Interface.

**UNIT-V**

**Opinion Mining and Sentiment Analysis:** Sentiment Classification, Feature-Based Opinion Mining and Summarization, Comparative Sentence and Relation Mining, Opinion Search, Opinion Spam.

**Web Usage Mining:** Data Collection and Pre-Processing, Data Modeling for Web Usage Mining, Discovery & analysis of web usage patterns.

**Suggested Reading:**

Human Computer Interaction

Credits: 3

Instruction: 3L hrs per week  Duration of SEE: 3 hours

CIE: 30 Marks  SEE: 70 Marks

UNIT- I


UNIT- II

Discovery: Discovery Phase Framework, Collection, Interpretation, Documentation

UNIT- III

Interaction Design Models: Model Human Processor, Keyboard Level Model, GOMS, Modeling Structure, Modeling Dynamics, Physical Models
Usability Testing: Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data

UNIT- IV

Interface Components: The WIMP Interface, Other Components
UNIT- V


Speech and Hearing: The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound


Suggested Reading:

CS 5104

Object Oriented Software Engineering

Credits: 3

Instruction : 3L hrs per week

Duration of SEE : 3 hours

CIE : 30 Marks

SEE : 70 Marks

UNIT-I

Information Systems: Problems in Information systems Development, Project life cycles, Managing
Information System Development, User Involvement and Methodological Approaches, Basic Concepts

UNIT-II

Requirement Capture, User Requirements, Requirements Capture and Modelling, Requirement
Analysis, Use Case Realization, The Class Diagram, Assembling the Analysis Class Diagram,
Refining the Requirement Models, Component-based Development, Software Development
Patterns, Object Interaction, Object Interaction and Collaboration, Interaction Sequence
Diagrams, Collaboration Diagrams, Model Consistency

UNIT-III

Specifying Operations, The Role of Operation Specifications, Contracts, Describing Operation
Logic, Object Constraint Language, Creating an Operation Specification, Specifying Control,
States and Events, Basic Notation, Further Notation, Preparing a Statechart, Consistency
Checking, Quality Guidelines, Moving Into Design, Logical and Physical Design, System
Design and Detailed Design, Qualities and Objectives of Analysis and Design, Measurable
Design, Software Architecture, Concurrency, Processor Allocation, Data Management Issues,
Development Standards, Prioritizing Design Trade-offs, Design for Implementation

UNIT-IV

Object design, Class Specification, Interfaces, Criteria for Good Design, Designing Associations,
Integrity Constraints, Designing Operations, Normalization, Design Patterns, Software
Development Patterns, Documenting Patterns-Pattern Templates, Design Patterns, How to use
Design Patterns, Benefits and Dangers of Using Patterns, Human Computer Interaction, The
User Interface, Approaches to User Interface Design, Standards and Legal Requirements,
Designing Boundary Classes, The Architecture of the Presentation Layer,
Prototyping the User Interface, Designing Classes, Designing Interaction with Sequence Diagrams, The Class Diagram Revisited, User Interface Design Patterns, Modelling the Interface Using Statecharts.

UNIT-V


Suggested Reading:

CS 5154

With effect from the Academic year 2017-2018

Parallel Algorithms

Credits: 3

Instruction : 3L hrs per week  
Duration of SEE : 3 hours

CIE : 30 Marks  
SEE : 70 Marks

UNIT-I


UNIT-II


Dense Matrix algorithms: Matrix vector Multiplication and Matrix- matrix multiplication

UNIT-III


UNIT-IV


UNIT-V


Suggested Reading:


Advanced Computer Networks

Credits: 3

Instruction: 3L hrs per week, Duration of SEE: 3 hours
CIE: 30 Marks, SEE: 70 Marks

UNIT I

History of Computer Networks and the Internet: Protocol Layers and Their Service Models, Review of OSI and TCP/IP Delay, Loss, and Throughput in Packet-Switched Networks

UNIT II


UNIT III


UNIT IV

UNIT V


Suggested Reading:

Parallel and Distributed Databases

Credits: 3

Instruction: 3L hrs per week
Duration of SEE: 3 hours

CIE: 30 Marks
SEE: 70 Marks

UNIT-I


UNIT-II

Query Processing: Overview, Measures of query cost, Selection operation, sorting, Join operation, Other operations, Evaluation of Expressions.


UNIT-III

Parallel Systems: Speedup and Scaleup, Interconnection Networks, Parallel Database Architectures.


UNIT-IV

Distributed Databases: Reference architecture for DDB, Types of Data Fragmentation, Distribution Transparency for Read-only applications, Distribution Transparency for Update applications, Distributed Database Access Primitives, Integrity Constraints in DDB.

UNIT-V

Translation of Global Queries to Fragment Queries: Equivalence transformations for queries, Transforming global queries into fragment queries, Distributed grouping and aggregate function evaluation, Parametric queries.


Suggested Reading:

Wireless Sensor Networks

Credits: 3

Instruction: 3L hrs per week
Duration of SEE: 3 hours

CIE: 30 Marks
SEE: 70 Marks

UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V

Suggested Reading:


CS 5255

Storage Management

Credits: 3

Instruction : 3L hrs per week
Duration of SEE : 3 hours

CIE : 30 Marks
SEE : 70 Marks

UNIT -I

Introduction to Information Storage and Management, Storage System Environment, Intelligent Storage System.

UNIT -II

Direct-Attached Storage and Introduction to SCSI, Storage Area Networks, Network-Attached Storage.

UNIT -III

IP SAN, Content-Addressed Storage, Storage Virtualization.

UNIT -IV

Introduction to Business Continuity, Backup and Recovery, Local Replication.

UNIT -V

Remote Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure.

Suggested Reading:

Performance Evaluation of Computing

Credits: 3

Instruction: 3L hrs per week
Duration of SEE: 3 hours

CIE: 30 Marks
SEE: 70 Marks

UNIT -I

Fundamental Concepts and Performance Measures


UNIT –II


UNIT -III

Queuing Theory: Networks of Queues, Estimating Parameters and Distributions

Computational Methods for Queuing Network Solutions, Simulation Analysis

Simulation Process, Time Control, Systems and Modeling, Simulation Languages, Applications of Simulation.

UNIT -IV


Hardware Testbeds, Instrumentation, Measurement, Data Extraction, and Analysis


System Performance Evaluation Tool Selection and Use: Validation of Results, Conducting Experiments, Performance Metrics, Evaluation
UNIT -V

Analysis of Computer Architectures:Case I : Central Server Computer System

Case II : Multiple Server Computer System

Case III : Petri Net Example

Analysis of Operating System Components

System Architectures, Workloads, Experimental Design and Simulation, Experimental Analysis and Conclusion.

Database Systems Performance Analysis


Analysis of Computer Networks Components

Analytical Modeling Examples, Simulation Modeling of Local Area Networks.

Suggested Reading:


CS 5304

With effect from the Academic year 2017-2018

Real Time Operating Systems

Credits: 3

Instruction : 3L hrs per week  Duration of SEE : 3 hours

CIE : 30 Marks  SEE : 70 Marks

UNIT I


Portable Operating System Interface (POSIX) – IEEE Standard 1003.13 & POSIX real time profile. POSIX versus traditional Unix signals, overheads and timing predictability.

UNIT II


UNIT III


UNIT IV

VxWorks – POSIX Real Time Extensions, timeout features, Task Creation, Semaphores (Binary, Counting), Mutex, Mailbox, Message Queues, Memory Management – Virtual to Physical Address Mapping.

UNIT V

Debugging Tools and Cross Development Environment – Software Logic Analyzers, ICEs.

Comparison of RTOS – VxWorks, µC/OS-II and RT Linux for Embedded Applications.
Suggested Reading:

Simulation and Modeling

Credits: 3

Instruction : 3L hrs per week  Duration of SEE : 3 hours
CIE : 30 Marks  SEE : 70 Marks

UNIT I

UNIT II
Overview of Statistical Models and Queuing Systems, Programming languages for Simulation: Continuous and Discrete Simulation Languages – GPSS, SIMAN, SIMSCRIPT, MATLAB and SIMULINK

UNIT III

UNIT IV
Input Data Analysis: Data Collection: Identify the Distribution, Parameter and Estimation.
Goodness of fit tests: Chi-Square Test – KS Test; Multivariate and time series input models, Verification and Validations of Simulation Models, Model Building, Verification and Validation: Verification of Simulation Models, Calibration and Validation of Models, face validity, Validation of Model Assumptions. Validation Input/output Transformations, Input/output Validation using Historical Input Data, Input/output Validation Sing Turning Test.
UNIT-V

**Output Data Analysis:** Stochastic, Nature of output data, Types of Simulation with respect to output Analysis, Measures of Performance and their Estimation, output Analysis for Terminating Simulations, Output Analysis for steady – State Simulations.

**Comparison and Evaluation of Alternative System Designs:** Comparison of several system Designs, Statistical Models for Estimating the Effect of Design Alternatives

**suggested Reading:**