COURSE STRUCTURE

M.TECH.

COMPUTER SCIENCE & ENGINEERING

Under

Choice Based Credit System (CBCS)
# First Semester

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# Second Semester

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## Course Curriculum (w.e.f. Session 2018-19)

**M.Tech. (CSE)**

### Third Semester

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COURSE STRUCTURE
M.TECH. (CSE)
PART TIME
## Course Curriculum (w.e.f Session 2018-19)
### M.Tech. (CSE)

#### DEPARTMENT OF COMPUTER ENGINEERING & APPLICATIONS, Institute of Engineering & Technology

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DEPARTMENT OF COMPUTER ENGINEERING & APPLICATIONS, Institute of Engineering & Technology
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DEPARTMENT OF COMPUTER ENGINEERING & APPLICATIONS, Institute of Engineering & Technology
SYLLABUS

M.TECH. (CSE)
MCSC0001: THEORY OF COMPUTATION

Objective: Make students understand the fundamental questions of computer science:
- What problems can be solved by a computation?
- How hard is it to compute solutions?
- How can we express computation?

Develop students’ ability to understand and conduct mathematical proofs for computation and algorithms.

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<td>I</td>
<td>Chomsky Hierarchy of Grammars and the corresponding acceptors, Decidability – Decidable languages, The Halting Problem, Undecidable Problems about Turing Machines, Post’s Correspondence Problem, Reducibility, Self-reference and the Recursion Theorem.</td>
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<tr>
<td>II</td>
<td>Complexity theory - Measuring Complexity, Nontrivial examples of polynomial-time algorithms, The concept of a reduction, P, NP, and NP-completeness; the Cook-Levin Theorem, The P versus NP problem and why it’s hard. Introduction to Cryptography - Perfect secrecy and its limitations, Computational Approach to Cryptography, Computational security, one-way functions and pseudorandom generators, Pseudorandom generators from one-way permutations.</td>
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<td>III</td>
<td>Probabilistic Turing machines and their examples, One-sided and “zero-sided” error: RP, coRP, ZPP. Trapdoor one-way functions, Zero Knowledge Proofs, some applications - Pseudorandom functions, tossing coins over the phone and bit commitment, Secure multiparty computations, Lower bounds for machine learning. Probably approximately correct (PAC) learning, Introduction to Quantum, Quantum Mechanics and BQP.</td>
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Teaching Hours
- I: 18
- II: 17
- III: 17

References:

Outcomes:
On successful completion of this course, students should be able to:
- Design, manipulate, and reason about formal computational models.
- Describe the limitations of different types of computing devices.
- Identify relations between classes of computational problems, formal languages, and computational models.
- Account for the inherent complexity of many computational problems of practical importance.
- Conduct formal reasoning about machines, problems and algorithms, including reduction-based proof.
## Course Curriculum (w.e.f Session 2018-19)

### M.Tech. (CSE)

**DEPARTMENT OF COMPUTER ENGINEERING & APPLICATIONS, Institute of Engineering & Technology**

### MCSC0002: SOFTWARE ENGINEERING METHODOLOGIES

**Objective:** To understand the concepts and methods required for the development of large software intensive systems. Further, to provide an account of validation of various systems through formal methods.

**Credits: 04**

**Semester I**

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<td>II</td>
<td><strong>Software Design Patterns</strong> Issues in software design: modularity based cohesion &amp; coupling Function oriented analysis &amp; design. Software Architecture description languages - Product-line architectures; Component based development <strong>Software Quality Engineering</strong> Testing Techniques – Test Case Generation, Software Maintenance schemes Software testing: strategies and assessment, COTS, Software reliability metrics &amp; modeling, Software quality: models and assurance framework, Software Maintenance.</td>
<td>17</td>
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**References:**

- Roger S Pressman (2005), *“Software Engineering – A Practitioner’s Approach”, 6/E*, MGH,
- Schmidt, Stal, Rohnert, and Buschmann (2000), *“Pattern-Oriented Software Architecture” Volume 2: Patterns for Concurrent and Network ed Objects”, Wiley

**Outcomes:**

Upon successful completion of this course it is expected that students will be able to demonstrate:

- ability to develop, maintain and evaluate large-scale software systems
- ability to produce efficient, reliable, robust and cost-effective software solutions
- ability to critically evaluate assumptions and arguments
- ability to apply the principles, tools and practices of IT project management
- ability to manage time, processes and resources effectively by prioritising competing demands to achieve personal and team goals
- ability to understand and meet ethical standards and legal responsibilities
- ability to rapidly learn and apply emerging technologies
MCSC0003: ADVANCED CONCEPTS IN DATA MINING

Objective:
- To understand the advanced principles, concepts and applications of data mining
- To introduce the task of data mining as an important phase of knowledge recovery process.
- Analyze the data for various applications.

Credits: 04

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<td>Introduction of Data Mining: Fundamentals, Data Mining Functionalities, Classification of Data Mining systems, Major issues in Data Mining, Data Mining Primitives. Association Rules: Basic Concepts, Apriori Algorithm, Data Formats for Association Rule Mining, Mining with Multiple Minimum Supports- Extended Model and Mining Algorithm, Mining Class Association Rules- Problem Definition and Mining Algorithm. Sequential Patterns: Basic Concepts, Mining Sequential Patterns Based on GSP, GSP Algorithm, Mining Sequential Patterns Based on PrefixSpan- PrefixSpan Algorithm, Generating Rules from Sequential Patterns-Sequential Rules and Label Sequential Rules.</td>
<td>18</td>
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</table>

References:
- Jiawei Han and. Micheline Kamber (2003) “Data Mining – Concepts and Techniques”, 3rd Edition Morgan Kaufmann.

Outcomes:
On successful completion of this course, students should be able to:
- To map and implement various algorithms with respective application domain
- To know the knowledge Discovery process.
- Application area of supervised and unsupervised learning in various application domains.
MCSC0004: ADVANCED CONCEPTS IN NETWORKING

Objective: To make students understand the protocols, algorithms and tools needed to support the development and delivery of advanced network services over networks.

Credits: 04  Semester I  L-T-P: 4-0-0

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| I          | **Introduction:** Networking overview, MAC layer issues, Ethernet 802.3, ARP, IP addressing and Subnetting, NAT and PAT, Variable Length Subnet Masking, CIDR  
**Advanced routing in the Internet and traffic engineering:** Intra domain routing: OSPF and IS-IS, Inter domain routing: BGP, Traffic Engineering  
**MPLS network:** MPLS basics, MPLS signaling, MPLS VPN  
**Internet multicasting:** IP multicasting, Application layer (Overlay) multicasting | 18             |
| II         | **TCP connection establishment and termination:** Sliding window concepts, other issues: wrap around, silly window syndrome, Nagle's algorithm, adaptive retransmission, TCP extensions.  
**End-to-End Congestion Control:** Tahoe, Reno, Vegas  
**Network based congestion control:** RED and ECN, Multicast congestion control.  
**Multimedia networking:** Introduction to multimedia networking, Video streaming over the Internet.  
**Internet QoS:** QoS fundamentals, Internet Differentiated services, Internet Integrated Services. | 17             |
| III        | **Peer-to-Peer networks and applications:** Peer-to-Peer file sharing networks, Peer-to-Peer streaming networks, Concept of overlays, Unstructured Overlays: Gnutella, Concepts of Distributed Hash Table, Structured Overlays: Chord, CAN, Pastry.  
**Wireless mobile networks:** Introduction to wireless networks, Wireless LAN, Cellular Networks, Mobile IP | 17             |

References:

Reading List

Outcomes:
After the completion of the course, the student will be able to:
- Understand OSI model and TCP/IP. Explain the function(s) of each layer and how they can be used to assist in network design and implementation.
- Familiarity with the basic protocols of computer networks, and is able to apply this understanding in modifying or implementing additional protocols. Understand and analyze the challenges of P2P networks and wireless networks.
## Course Curriculum (w.e.f. Session 2018-19)
### M.Tech. (CSE)

**MCSC0005: PROBABILITY & STOCHASTIC PROCESSES**

**Objective:** To introduce the concepts of probability and stochastic processes and illustrate these concepts with engineering applications to support other courses and research in computer engineering.

### Module No. | Content | Teaching Hours
--- | --- | ---
I | **Basic Probability:** Introduction, definitions of probability, set theory, axioms of probability, Conditional probability, Total probability and Bayes' theorem. **Random Variables:** Definition, Cumulative Distribution Function (CDF), continuous, discrete and mixed Random Variables, Probability Density Function (PDF), Probability Mass Function (PMF). | 18

II | **Properties of Random Variables:** Moments of Random variables: Mean and variance of random variable, Coefficients of variation, Skewness and kurtosis, Moments, Covariance and correlation coefficient. Properties of Distribution Functions, **Specific Random Variables:** Gaussian, Exponential, Rayleigh, Uniform, Binomial and Poisson Distributions. **Hazard Rate:** Definition, hazard rate of Exponential distribution, Gamma distribution, Weibull distribution | 17

III | **Stochastic Processes:** Definition and Classification of Stochastic Processes, Poisson process, Birth and Death Process, Applications to Queues, Discrete Time Markov Chains, Limiting Distributions – Theory of M/M/1 and M/M/m queues – Little's Theorem | 17

### Text Book:
- Kishore S. Trivedi, "Probability and Statistics with Reliability, Queuing and Computer Science Applications" Wiley

### References:

### Outcomes:
**At the end of this course the students will be able to:**
- Apply concept of probability and random variables in the area of computer networks, Image processing etc.
MCSC0800: PROBLEM SOLVING LAB - I

Objective: The purpose of this course is to introduce the students to the field of programming, where they will be able to enhance their analyzing and problem solving skills.

Credits: 01  Semester I  L–T–P: 0–0–2

- Elementary Programming
- Expressing computations.
- Process of writing and debugging a program
- Process of moving from a problem statement to a computational formulation of a method for solving the problem.
- Set of programming rules to apply algorithms to form solutions.
# MCSC0006: MOBILE AD-HOC NETWORKS

**Objective:** This course will enable the students to understand the detailed concept related to Mobile Ad-hoc Networks.

**Credits:** 04

## Contents

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>

## References:


## Outcomes:

At the end of this course the students will be able to:

- Understand applications and research issues of Mobile Ad-Hoc Networks.
- Getting concept of establishing the MANET.
- Various devices used in MANET
- Routing protocols used in MANET
Objective: The learning objectives of this course are to acquaint students with theory and principles of intelligent systems and with representative practical systems.

Credits: 04 Semester II L–T–P : 4–0–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Uncertainty</strong> – Basic Probability notion, The Axiom's of probability, Bayes' Rule &amp; its use. <strong>Probabilistic reasoning</strong> – Bayesian Networks, Exact &amp; Approximate Inference in Bayesian Networks, <strong>Artificial Neural Networks</strong>: Introduction, Neuron Physiology, Artificial Neurons, Learning, Feed forward &amp; feedback networks, Training algorithms: Delta rule, Perceptron learning rules, Back propagation, RBFN.</td>
<td>17</td>
</tr>
</tbody>
</table>

References:
- Stuart Russell, Peter Norvig (2009), "Artificial Intelligence – A Modern Approach", Pearson
- NP Padhy(2010), "Artificial Intelligence & Intelligent System", Oxford
- ZM Zurada, "Introduction to Artificial Neural Systems", West Publishing Company
- Timothy J Ross (2004), "Fuzzy Logic with Engineering Applications", John Wiley & Sons Ltd.

Outcomes:
At the end of this course the students will be able to:
- Describe the attributes of various search techniques and the situations to which they are well-suited
- Understand a range of techniques of intelligent systems across artificial intelligence (AI) and intelligent agents (IA); both from a theoretical and a practical perspective.
- describe and apply various techniques for logic programming and machine learning
**MCSC0008: INFORMATION RETRIEVAL**

**Objective:** The objective of the course is to introduce students to the theoretical basics of information retrieval (IR).

**Credits: 04**  
**Semester II**  
**L-T-P: 4-0-0**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Basic Concepts, Retrieval Process  
| II         | **Query Languages and Operations:** Keyword based Querying, Pattern Matching, Structural Queries, User Relevance Feedback.  
**Text Operations:** Document Preprocessing, Document Clustering, Text Compression.  
**Evaluation in Information Retrieval:** Retrieval Performance Evaluation Recall, Precision, Mean average Precision, F-Measure, User Oriented Measures, Discounted Cumulated Gain. TREC Web Collections. | 17 |
| III        | **Searching the Web:** Characterizing the web, Crawling the Web, Mercator: A Scalable, Extensible Web Crawler, Parallel Crawlers, Different Types of Web Crawler, Anatomy of a Large-Scale Hypertextual Web Search Engine, Page Rank Algorithm.  
**IR Applications:** Summarization and Question Answering. | 17 |

**References:**


**Outcomes:**

At the end of this course the students will be able to:

- To apply Information retrieval concepts, algorithms and approaches for efficient and meaningful information retrieval from digital library, search engine etc.
## MCSC0009: IMAGE PROCESSING AND ANALYSIS

**Objective:** To cover the basic theory and algorithms that are widely used in digital image processing and analysis.

**Credits:** 04  
**Semester II**  
L–T–P: 4–0–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Digital Image Fundamentals:** Image sampling & quantization; Basic relationships between pixels, Some mathematical tools used in digital image processing.  
**Image perception:** Light, luminance, brightness and contrast, Human Visual System, Colour representation, Chromaticity diagram, Colour Coordinate Systems.  
**Image Enhancement:** Overview, Contrast Intensification, Smoothing, Sharpening, Basic intensity Transformation functions, Histogram processing, Spatial filters, Image Restoration | 18 |
| II         | **Image Transforms:** Discrete Fourier Transform, DCT Transform, KLT Transform, Wavelet Transform. Image Enhancement in Frequency Domain  
**Image Compression:** Fundamentals, Lossless Compression: Huffman Coding, Arithmetic Coding, Run-length Coding. Lossy Compression: JPEG Coding.  
**Image Registration:** Geometric Transformation, Registration by Mutual Information Maximization | 17 |
| III        | **Image Analysis:** Fundamental concepts, Segmentation: Region extraction, Pixel based approach, Thresholding, Region based approach. Canny Edge Detection.  
**Feature Extraction:** Representation, Topological Attributes, Geometrical Attributes, Spatial Moments, Boundary based Description, Region based Description, and Intensity based Description.  
**Object Recognition:** Patterns and pattern classes, Recognition based on decision-theoretic methods, structural methods. | 17 |

**References:**

**Outcomes:**
Upon completion of this course, students will be familiar with basic image processing techniques for solving real problems. Student will also have sufficient expertise in both the theory of two-dimensional signal processing and its wide range of applications, for example, image enhancement, image compression and image analysis.
### MCSC0010: DESIGN OF DISTRIBUTED SYSTEMS

**Objective:** To understand the fundamental principles, architectures, algorithms and programming models used in distributed systems and their extension in grid and cloud computing.

**Credits:** 04

**Semester II**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I | **Introduction:** Introduction, Types, Design Issues, Models, Theoretical foundations of DS, Case Study of Amobea.  
**Distributed Mutual Exclusion:** Classification, Requirements, Performance Measurement, Non-Token Based Algorithm & Token Based Algorithm, Shared Memory based Mutual Exclusion  
**Communication in Distributed System:** Communication Between Distributed Objects, Events, Inter Process Communication- RPC, Distributed Objects and Middleware – Overview of trends. Challenges and Opportunities.  
**Distributed File Systems** – Introduction, Issues, Mechanism for building distributed file systems, Reliability & Performance in traditional DFS, Case Study – AFS, NFS, CODA | 18 |
| II | **Failure Recovery:** Introduction, types, Recovery in concurrent and replicated distributed database system, Checkpoint Based Recovery  
**Fault Tolerance:** Issues, Commit Protocols, Voting Protocols  
**Distributed Scheduling** – Issues in Load Distributing, Components, Stability, Load Distributing algorithm, Performance Comparison, Task Migration and issues  
**Distributed shared memory**- Architecture & Motivation, Memory coherence, Coherence Protocol, Design Issues Case Study- IVY | 17 |
| III | **Distributed Web-Based Systems** – Architecture, Processes, Naming, Synchronization, Consistency and Replication  
**Distributed Coordination-Based Systems**- Introduction To Coordination Models, Architectures, Processes, Communication  
**Grid Computing** – Definition, Benefits, Issues, Types of Resources, Scheduling, reservation, and scavenging, Grid architecture models, Grid topologies, Case Study – Globus Toolkit  
**Cloud Computing** – Definition, Properties, Characteristics & Disadvantages, Cloud Computing Architecture, Service Models, Deployment Models, Resource Virtualization, Case Study – Amazon EC2 | 17 |

**Text Book:**

**References:**

**Outcomes:**
- Understanding of the technical demands and potential solutions for distributed systems that impose high requirements on data storage and transport. A sound understanding of the principles and concepts involved in designing distributed systems and Internet applications Ability to implement a distributed application.
MCSC0802: PROBLEM SOLVING LAB - II

**Objective:** The purpose of this course is to introduce the students to the field of programming, where they will be able to enhance their analyzing and problem solving skills.

Credits: 01  
Semester II  
L–T–P: 0–0–2

- Elementary Programming
- Expressing computations.
- Process of writing and debugging a program
- Process of moving from a problem statement to a computational formulation of a method for solving the problem.
- Set of programming rules to apply algorithms to form solutions.
MCSC0802: IMAGE PROCESSING & ANALYSIS LAB

Objective: To illustrate concepts in image processing and analysis through actual processing of images using MATLAB.

Credits: 01  Semester II  L-T-P: 0-0-2

- Recap of MATLAB Toolboxes, Relational and Logical Operators, Matrix Manipulation functions, Matrix Element wise operations, Elementary Math functions.
- Familiarization with MATLAB Loops
- Histogram manipulations, sub sampling an image, flipping an image
- Basic Operations on Images – gray level slicing, Contrast Stretching, Transformations, smoothing using linear & order statistics filters of varying sizes
- Sharpening an image, linear spatial filtering, handling various types noise
- Discrete Fourier Transform and its application on an image
- Morphological Operations, boundary extraction, finding connected components.
- Implementing various edge detection algorithms and comparing their results.
- Image segmentation using global thresholding, segmenting a text page using p-tile method.
- Applying Region growing, Region splitting and Region merging techniques for image segmentation.
- Program based on Feature Extraction
- Mini Project based on above concepts

References:

Outcomes:
On completing this course the student will be able to
- describe and explain basic principles of digital image processing;
- design and implement algorithms that perform basic image processing
- design and implement algorithms for advanced image analysis

DEPARTMENT OF COMPUTER ENGINEERING & APPLICATIONS, Institute of Engineering & Technology
# MCSE0001: COMPUTER VISION

**Objective:** To introduce the principles, models and applications of computer vision. To develop an appreciation for various issues in the design of computer vision and object recognition systems

**Credits:** 04

**Semester III**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Overview to Computer Vision, Image formation – Geometric primitives and transformations, Photometric Image formation.  
**Digital Camera:** Sampling & aliasing, Colour, Compression, Camera model & calibration, Epipolar Geometry, Stereopsis.  
**2D Shape** – Hough transform, Shape numbers, Pyramids, Quad Trees, Medial Axis Transform. | 18 |
| II         | **Recognition:** Detectors and Descriptors, clustering (K-Mean and Mean Shift), Interest Point Detection, Harris Corner Detector, SIFT, Template Matching, Detection with sliding windows: Viola Jones, Object recognition (Eigenfaces, Active appearance models).  
**Classification:** K-nearest Neighbours Algorithm, Statistical Classification, Bag-of-Words Models, Overview of methods for building Classifies, a part-based generative model (Constellation model) and a part-based discriminative model (Latent SVM), | 17 |
| III        | **Motion Analysis:** Motion estimation using Optic Flow, Video Change Detection, moving object detection - Background Subtraction approach, moving object detection using Gaussians Mixture Model (GMM) approach. Object Tracking, Kernel (Mean Shift) based Object Tracking, Motion Models to aid tracking (Kalman Filtering, particle filtering), Data Association, Applications of Object Tracking. | 17 |

**References:**

**Outcomes:**
- The outcome of this course is to develop the theoretical and algorithmic basis by which useful information about the world can be automatically extracted and analyzed from a single image, a set of images or video.
### Objective:
To make students understand the protocols, algorithms and tools needed to support the deployment and functionality of wireless sensor networks.

**Credits:** 04

### Semester III

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Applications and Design Model: Examples of available sensor nodes, Sample sensor networks applications, Design challenges, Contemporary network architectures, Operational and computational models, Performance metrics, Software and hardware setups. <strong>Network Bootstrapping:</strong> Sensor deployment mechanisms, Issues of coverage, Node discovery protocols <strong>Physical and Link layers:</strong> Radio energy consumption model, Power Management, Medium access arbitration: Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, Optimization mechanisms</td>
<td>18</td>
</tr>
<tr>
<td>II</td>
<td>Localization and Positioning: Properties of positioning, Possible approaches, Mathematical basics for the lateration problem, Single-hop localization, Positioning in multi-hop environments, Impact of anchor placement. <strong>Topology control:</strong> Motivation and basic ideas, Flat network topologies, Hierarchical networks by dominating sets, Hierarchical networks by clustering, Combining hierarchical topologies and power control, Adaptive node activity. <strong>Naming and Addressing:</strong> Address and name management in wireless sensor networks, Assignment of MAC addresses, Distributed assignment of locally unique addresses, Content-based and geographic addressing</td>
<td>17</td>
</tr>
<tr>
<td>III</td>
<td>Routing protocols: The many faces of forwarding and routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Coping with energy constraints, Mobile nodes. <strong>Data-centric and content-based networking:</strong> Introduction, Data-centric routing, Data aggregation, Data-centric storage. <strong>Dependability Issues:</strong> Security challenges, Threat and attack models, Quality of service provisioning, Time Synchronization: Introduction to the time synchronization problem, Protocols based on sender/receiver synchronization, Protocols based on receiver/receiver synchronization, Supporting fault tolerant operation.</td>
<td>17</td>
</tr>
</tbody>
</table>

### Reference s:

### Outcomes:
After the completion of the course, the student will be able to:
- Assess coverage and conduct node deployment planning, devise appropriate data dissemination protocols and model links cost, determine suitable medium access protocols and radio hardware.
- Provision quality of service, fault-tolerance, security and other dependability requirements and conduct trade-off analysis between performance and resources.
- Evaluate the performance of sensor networks and identify bottlenecks.
- Understand the Sensor management, sensor network middleware, operating systems.
### Objective:
To understand basic concepts, theories, and techniques used in service-oriented architecture, along with governance strategies and trends in SOA.

### Credits: 04

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Software Architecture – Types of IT Architecture, SOA Evolution, Key components, perspective of SOA, Enterprise-wide SOA Architecture, Enterprise Applications, Solution Architecture for enterprise application Software platforms for enterprise Applications, Patterns for SOA, SOA programming models.</td>
<td>18</td>
</tr>
<tr>
<td>III</td>
<td>Introduction to Web Services and Security, SOA implementation and Governance strategy, trends in SOA, event-driven architecture, software as a service. SOA Delivery Strategies- SOA delivery lifecycle phases. Transaction processing – paradigm, protocols and coordination, transaction specifications, SOA in mobile, research issues in SOA.</td>
<td>17</td>
</tr>
</tbody>
</table>

### References:

### Outcomes:
After the completion of the course, the student will be able to:
- Understand primary concepts of SOA
- Know the integration of SOA technological points with Web Services.
- Implement SOA in development cycle of Web Services
**MCSE0004: PATTERN RECOGNITION**

**Objective:** Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms

**Credits: 04**  
**Semester III**  
**L–T–P: 4–0–0**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Introduction:</strong> Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.</td>
<td>18</td>
</tr>
<tr>
<td>II</td>
<td><strong>Statistical Pattern Recognition:</strong> Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, <strong>Parameter estimation methods:</strong> Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.</td>
<td>17</td>
</tr>
</tbody>
</table>

**References:**


**Outcome:**

*After the completion of the course, the student will be able to:*

- Understand a variety of pattern recognition algorithms, along with pointers on which algorithms work best under what conditions, so that students can make sound decisions on what approaches to take when faced with a real world problem.
MSE0005: HIGH PERFORMANCE COMPUTING

Objective: This subject introduces students to the essential tools and techniques of high performance computing. The main objectives are to introduce students to different frameworks of parallel and distributed computing that they can use in their specific areas of interest. The students may learn to program multi-core processors as well as clusters of personal computers using the widely used computer languages.

Credits: 04

Semester III

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Overview of Parallel Techniques: Classification of Instruction Set Architectures, Instruction level, Thread level and Process level. Pipelining: Instruction and functional pipelines, Hazards in a pipeline, Branch prediction techniques; Superscalar Techniques. Memory Hierarchies: Basic hierarchical memory concepts, Cache design, Virtual memory design &amp; uses, Memory hierarchy performance. Parallel Programming Concepts: Abstract Machine Models – RAM&amp; PRAM, various parallel algorithms on them.</td>
<td>18</td>
</tr>
</tbody>
</table>

References:


Outcomes:

At the end of this course the students will be able to:

- Understand the concept and terminology of High Performance Computing.
- Write and analyze the behavior of High Performance Parallel programs for distributed memory architecture, share memory architecture using MPI, Open MP and Pthreads.
MCSE0006: WEB MINING

Objective: Introduce students to the basic concepts and techniques Web Mining for extracting knowledge from the web.

Credits: 04

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Introduction:</strong> Basic Concepts of Web Mining, Classification of Web Mining: Web Content Mining, Web Structure Mining, Web Usage Mining, Issues in Web Mining. Crawling the Web, Hyperlink Analysis, Basics of HTML, HTTP, HTTPS and scripting. <strong>Web Content Mining:</strong> document indexing and retrieval in the web environment, web documents categorization and clustering, Text and Web Page Pre-Processing.</td>
<td>18</td>
</tr>
<tr>
<td>II</td>
<td><strong>Web Structure Mining:</strong> Anchor Text, Hyperlink Analysis, Static and Dynamic Hyperlinks, Web Graph, Web Search, Query Expansion, Primary web browsing (crawling), Link topology analysis. <strong>Social Network Analysis:</strong> Social Sciences and Bibliometry, Prestige, Centrality, Co-citation, PageRank and HITS, Stochastic HITS and Other Variants, Enhanced Models and Techniques, Avoiding Two-Party Nepotism, Outlier Elimination, Exploiting Anchor Text. <strong>Evaluation of Topic Distillation:</strong> HITS Algorithm.</td>
<td>17</td>
</tr>
<tr>
<td>III</td>
<td><strong>Web Usage Mining Process and Techniques:</strong> Data collection and PreProcessing, Data modeling for web usage mining. Discovery and analysis of web usage patterns, Session and visitor analysis, Cluster analysis and visitor segmentation. <strong>Resource Discovery:</strong> Collecting important pages preferentially, crawling as guided search in a graph, Keyword-Based graph search, Similarity search using Link Topology. <strong>The Future Of Web Mining:</strong> Natural Language Processing, Lexical Networks and Ontologies, Part- of-Speech and Sense Tagging, Parsing and Knowledge Representation, Profiles, Personalization, Collaboration, Opinion mining.</td>
<td>17</td>
</tr>
</tbody>
</table>

References:

- Soumen Chakrabarti (2010) "Mining the Web: discovering knowledge from hypertext data, Part 2", Morgan Kaufmann Publisher.

Outcomes:

At the end of this course the students will be able to:

To apply Web Mining concepts, algorithms and approaches for efficient ranking of web pages from digital library, web search engine etc.