### Curriculum and Scheme of Examination of M.E. Program in Computer Science and Engineering

#### M.E. (CSE) First Year

<table>
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<tr>
<th>Sr. No.</th>
<th>SUBJECT</th>
<th>TEACHING SCHEME</th>
<th>EXAMINATION SCHEME</th>
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<td>L</td>
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<tr>
<td>01</td>
<td>Research Methodology (Audit course)</td>
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<td>02</td>
<td>Mathematical Foundations of Computer Science</td>
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<td>03</td>
<td>Data Structures and Algorithms</td>
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<td>06</td>
<td>Elective - I</td>
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<td>07</td>
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<tr>
<td>09</td>
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**TOTAL MARKS** 825

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<td>Advanced Operating System</td>
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<td>Object Oriented Software Engineering</td>
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<td>Advanced Computer Architecture</td>
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<td>Mini Project</td>
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**TOTAL MARKS** 825

#### ELECTIVE – I

1) Image processing  
2) Soft Computing  
3) Cloud Computing  
4) High Performance Computing  
5) Wireless & Mobile Computing

#### ELECTIVE – II

1) Cryptography & Network Security  
2) Distributed Computing  
3) Data Mining & Data Warehousing  
4) Computer Vision  
5) Pattern Recognition
**Class Tests**

The class tests are meant for continuous assessment of the students. The class tests should be evenly spread over the entire period of a term and should cover the entire syllabus. In a semester, three tests (each of one hour duration) should be conducted for each subject and average of the best two tests should be taken as class test marks in that subject.

**Seminar – I**

The seminar should be done on any topic in computer science & engineering to be decided by the students and the teacher concerned. Seminar work shall be in the form of report to be submitted by the students at the end of the semester. The candidate will deliver the talk on the topic for half an hour and assessment will be made by two internal examiners, one of them will be guide and the other appointed by the principal of college.

**Mini Project**

The student should submit a synopsis at the beginning of the semester for approval to the project committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the project committee for evaluation purpose at the end of the semester in a specified format.
First Year P.G. Program in Computer Science & Engineering

1. Research Methodology

Teaching Scheme: L: 2
Evaluation Scheme: Theory Test

Minimum Passing Marks (Audit Course)

Course Objectives

- To familiarize the students with the
- Approach to research and its design;
- Role of methodology; and Philosophical, theoretical, ideological and originality interface with research in general and empirical research in particular.

Course Contents

UNIT I (5 Hrs)

Concepts

UNIT II (8 Hrs)

Problem Definition
Literature Review, Sources of Literature, Maintain Literature data using Endnote2, Determining referencing procedure, For the Problem area to be identified, study efforts of past researchers and determine the anticipated variables to be studied. Determine the approach being developed is unique. Problem Formulation, Identifying variables to be studied, determine the scope, limitations and or assumptions, Justify basis for assumption, Formulate time plan for achieving targeted problem solution.

UNIT III (8 Hrs)

Research Design
Definition Research Design and its Functions, Research Instrumentation, Availability, Training, Theoretical Conceptualization, Setting up of experiments, understanding instrumentation characteristics, focusing on the information processing with output results. Examples: DSC, SEM, FTIR etc., Data Collection Forms, Validity, Reliability of Data, Calibrating Instruments. Analytical Techniques associated with the problem formulations, Software tools required for analytical problem definition and obtaining solution.
UNIT IV  
(8 Hrs)

Data Analysis  

UNIT V  
(8 Hrs)

Testing of Hypothesis  
Parametric and Non Parametric Hypothesis, Continuous Probability Distributions, Standard Normal Distribution, Confidence Intervals, Chi-Square Tests and Multivariate Analysis, Analysis of Variances. Use of Matlab, Excel or other tools for analysis and result interpretation, Bartlett’s test, Cochran’s test for testing Hypothesis, Regression Analysis, Experimental Design.

UNIT VI  
(5 Hrs)

Review Research  
Presenting research outcome at conferences and submitting papers to Journals, Identifying Journal publication procedures, Compiling Reports using Latex. Presenting Research Proposal to Internal Committee Experts, Determination of shortfalls in achieving targeted objectives, Identifying Problems and re describing final objectives, Determining Time Plan.

Recommended Books:

First Year P.G. Program in Computer Science & Engineering

2. Mathematical Foundations of Computer Science

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Course Objectives

- To understand the significance of number theory
- To learn different algebraic structures
- To study various concepts of linear algebra

Course Contents

UNIT I  (10 Hrs)

**Number theory**
Divisibility, gcd, prime numbers, fundamental theorem of arithmetic, Congruences, Fermat's theorem, Euler function, primality testing, solution of congruences, Chinese remainder theorem, Wilson’s theorem.

UNIT II  (10 Hrs)

**Algebraic Structures**
Groups and subgroups, homomorphism theorems, cosets and normal subgroups, Lagrange’s theorem, rings, finite fields.

UNIT III  (10 Hrs)

**Graph theory**
Graphs, Euler tours, planar graphs, graph colouring, Hamiltonian graphs, Euler's formula, applications of Kuratowski’s theorem.

UNIT IV  (6 Hrs)

**Linear Algebra**
Functions; Linear transformations and their inverses; Properties of linear transformations; Orthogonality, Orthogonal transformations, Inner product spaces, Introduction to determinants
UNIT V  

(6 Hrs)

**Eigenvectors and Eigen value**  
Definitions and examples of eigenvectors and eigen values; Computational methods for finding eigenvectors and eigen values; Properties of eigen vectors and eigen values; Matrix representations; Change of basis; Symmetric matrices and diagonalization.

**Reference Books:**

3. Data Structures and Algorithms

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<td>Theory</td>
<td>Test</td>
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Course Objectives

- To learn various algorithm design techniques
- To understand advanced data structures
- To learn various algorithm analysis techniques

Course Contents

UNIT I

(6 Hrs)

Foundations
Overview of basic data structures, role of algorithm in computing, asymptotic notations, recurrences, substitution method, recursion tree method, the master method, proof of Master theorem.

UNIT II

(4 Hrs)

Probabilistic Analysis & Randomized Algorithm
The hiring problem, Indicator random variables, Randomized algorithm, probabilistic analysis.

UNIT III

(10 Hrs)

Basic algorithm techniques
Dynamic programming, greedy algorithm, theoretical foundation of greedy methods, matroids, task scheduling problem, graph algorithms, maximum flow, amortized analysis.

UNIT IV

(8 Hrs)

Advanced Data Structures
Red-Black trees, B-trees, Binomial heaps, Fibonacci heaps, Skip lists, universal hashing, Data structures for maintaining ranges, intervals and Data structures for disjoint sets.
UNIT V

Complexity Classes
NP-Hard and NP-complete problems, Cook’s theorem, NP completeness reductions.

UNIT VI

Approximation Algorithms
Polynomial time and fully polynomial time approximation schemes.

Text Books:


Reference Books:

First Year P.G. Program in Computer Science & Engineering

4 Advanced Database Management Systems

Teaching Scheme L: 4
Evaluation Scheme Theory Test Minimum Passing Marks

100 Marks 25 Marks 40%

Course Objectives

- To study parallel, object oriented and distributed architectures of database systems.
- To understand web databases using XML.
- To familiarize with mobile and multimedia database systems.

Course Contents

UNIT I (10 Hrs)

Parallel And Distributed Databases

Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design- Types of Distributed Database Systems, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases-An Overview of 3-Tier Client-Server Architecture-Distributed Databases in Oracle, Cloud-Based Databases.

UNIT II (10 Hrs)

Object And Object Relational Databases
UNIT III

Xml and Web Databases
Web Database: Structured, Semi structured, and Unstructured Data, A Simple PHP Example, Overview of Basic Features of PHP, Overview of PHP Database Programming
XML Databases: XML Hierarchical (Tree) Data Model, XML Documents, DTD, and XML Schema, XML Documents and Databases, XML Querying

UNIT IV

Mobile Databases

UNIT V

Multimedia Databases
Types of multimedia information, multimedia database applications, multimedia object characteristics, MDDMS components, Multimedia storage and retrieval, Querying MMDB, MMDBMS Architecture.

Text Books:


Reference Books:

First Year P.G. Program in Computer Science & Engineering

5 Advanced Computer Networks

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Course Objectives

- To have succinct and in-depth study of IPv6 features and functions.
- Understand and learn to plan, design and integrate IPv6 with current IPv4 infrastructure.
- To acquaint with high speed networks such as SONET, ATM, BISDN and DWDM

Course Contents

UNIT-I


UNIT-II

Interoperability: Dual-Stack Techniques, Tunneling Techniques, Network Address and Protocol Translation, Comparison, ICMPv6: General Message Format, ICMP Error Messages, ICMP Informational Messages, Processing Rules, The ICMPv6 Header in a Trace File, Neighbor Discovery (ND), Autoconfiguration, Network Renumbering, Path MTU Discovery, Multicast Listener Discovery (MLD), Multicast Router Discovery (MRD).

UNIT-III

UNIT-IV  

(6 Hrs)

Upper-Layer Protocols: UDP/TCP, DHCP, DNS, SLP, FTP, Telnet, Web Servers
IPv6 Quality of Service: QoS Basics, QoS in IPv6 Protocols, Using QoS

UNIT V  

(8 Hrs)


UNIT VI  

(8 Hrs)

Performance of Circuit-Switched Networks: SONET, Dense Wave-Division Multiplexing (DWDM), Fiber to the Home, Digital Subscriber Line (DSL), Intelligent Networks, CATV, Asynchronous Transfer Mode: Main Features of ATM, Addressing, Signaling, and Routing, ATM Header Structure, ATM Adaptation Layer, Management and Control, BISDN, Internetworking with ATM.

Text Books:


Reference Books:

First Year P.G. Program in Computer Science & Engineering

ELECTIVE-I
1. Image Processing

Teaching Scheme  
L: 4

<table>
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<th>Theory</th>
<th>Test</th>
<th>Minimum Passing Marks</th>
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<td>100 Marks</td>
<td>25 Marks</td>
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Course Objectives

- Develop an overview of the field of image processing.
- Cover the basic theory and algorithms that are widely used in digital image processing.
- Develop hands-on experience in using computers to process images.
- Familiarize with MATLAB Image Processing Toolbox

Course Contents

UNIT I  
(8 Hrs)

Introduction:
What is image processing? , What are the fundamental issues? , What is the role of perception? Image sampling and quantization, Basic relationship between pixels, MATLAB orientations.

Image Transformations
Discrete Fourier transform, Properties of 2D DFT, FFT, Convolution, Correlation, Discrete cosine transform, Discrete Wavelet transform.

UNIT III  
(8 Hrs)

Image Enhancement Techniques

UNIT IV  
(4 Hrs)

Color image processing:
Color fundamentals, Color models, Color transformation, Smoothing and Sharpening.
UNIT V  
(7 Hrs)

**Image Compression:**

UNIT VI  
(6 Hrs)

**Morphological Image processing:**
Basics, Erosion, Dilation, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Hole filling, Connected components, Convex hull, Thinning, Thickening, Skeletons, Pruning.

UNIT VII  
(7 Hrs)

**Image Segmentation and Representation:**
Point, Line and Edge detection, Edge linking and Boundary detection, Thresholding, Basic global tresholding, Otsu’s method, Region based segmentation, Use of motion in segmentation.

**Text Books:**


**Reference Books :**

First Year P.G. Program in Computer Science & Engineering

ELECTIVE-I
2. Soft Computing

<table>
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Course Objectives

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing

Course Contents

UNIT I (10 Hrs)

Fuzzy Set Theory

UNIT II (8 Hrs)

Optimization
UNIT III (10 Hrs)

Neural Networks

UNIT IV (9 Hrs)

Neuro Fuzzy Modeling

UNIT V (8 Hrs)

Applications of Computational Intelligence

Text Books:

Reference Books:
First Year P.G. Program in Computer Science & Engineering

ELECTIVE-I

3. Cloud Computing

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Course Objectives

- To understand the emerging area of cloud computing, IT outsourcing, application virtualization and how it relates to traditional models of computing.
- To gain competence in Map Reduce as a programming model for distributed processing of large datasets. Specifically:
  - To understand and be able to articulate key concepts behind Map Reduce, including its functional abstraction, the use of distributed storage, and the scheduling of data-local jobs.
  - To understand how well-known algorithms such as Page Rank and inverted index construction can be expressed in the Map Reduce framework.
  - To gain competence in Ajax as a vehicle for delivering highly-interactive Web applications.

Course Contents

UNIT I (6 Hrs)

Cloud Computing Basics

UNIT II (8 Hrs)

Cloud Computing Platforms
UNIT III (8 Hrs)

Cloud Technologies

UNIT IV (10 Hrs)

Cloud Development
Data in the cloud: RDBMs, GFS and HDFS, BigTable, Hbase and Dynamo, Cloud Datastore-Datastore and SimpleDB, MapReduce and extensions, Dev 2.0 Platforms. Enterprise software, Custom Enterprise Applications and Dev 2.0, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem, Roadmap for enterprise cloud Computing.

UNIT V (8 Hrs)

Cloud Security

Text Books:

References Books:
First Year P.G. Program in Computer Science & Engineering

ELECTIVE-I
4. High Performance Computing

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Course Objectives
- To learn the parallel concepts and architectures.
- To study OpenCL
- To familiarize with CUDA architecture.

Course Contents

UNIT – I (8 Hrs)


UNIT – II (10 Hrs)

Introduction to CUDA: Data Parallelism; CUDA Program Structure; A Matrix-Matrix Multiplication Example; Device Memories and Data Transfer; Kernel Functions and Threading; Function declarations; Kernel launch; Predefined variables; Runtime API.CUDA Thread Organization; Using block Id X and thread Id x ; Synchronization and Transparent Scalability; Thread Assignment ; Thread Scheduling and Latency Tolerance.

UNIT – III (10 Hrs)

Parallel Programming with CUDA: Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem micro architecture) - Memory hierarchy and transaction specific memory design - Thread Organization
UNIT – IV

**Introduction to OpenCL**: OpenCL basics: devices, 4 models, kernel basics – Organization of an OpenCL program: kernel, platforms, devices, context, program, command queue, buffer read/write, release resources – Performance analysis of OpenCL programs – Examples in OpenCL

UNIT – V

**Case studies** – Applications like Matrix multiplication, Matrix MRI reconstruction Molecular Visualization and Gaming.

**Reference Books:**


**Reference Websites:**


**Reference Tools:**

1. AMD APP SDK Installation Notes
First Year P.G. Program in Computer Science & Engineering

**ELECTIVE-I**

5. Wireless And Mobile Computing

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**Course Objectives**

- To explore the trends in wireless and mobile computing.
- To study the cellular networks including 3G
- To familiarize with the mobile device technologies.

**Course Contents**

**UNIT I** (4 Hrs)

Introduction: Definition, Applications, Mobile and wireless devices, reference model, frequencies for radio transmission, Signals, Antennas, signal propagation, multiplexing, modulation, spread spectrum, cellular systems, motivation for specialized MAC, SDMA, FDMA, TDMA-fixed TDMA, classical aloha, slotted aloha, CSMA, DAMA, PRMA, reservation TDMA, MACA, polling, CDMA.

**UNIT II** (6 Hrs)

Cellular System fundamentals: Frequency reuse, handoff strategies, interference and system capacity, improving coverage and capacity.
GSM: services and features, system architecture, radio subsystem, channel types, frame structure, signal processing in GSM.

**UNIT III** (8 Hrs)

UNIT IV  

WLAN: Infra red vs radio, Infrastructure and ad-hoc, IEEE 802.11- system architecture, protocol architecture, physical layer, MAC layer, MAC management. Mobile Network and Transport Layer: Mobile IP, Traditional TCP and Classical TCP improvements.

UNIT V  

Mobile Device Technology: Hardware, Human-machine interface, Operating Systems-Palm OS, EPOC, Windows CE, QNX Nutrino, BeOS, Embedded Linux, Java for Pervasive devices. Introduction to Android Platform

UNIT VI  


Text Books:


References Books:

First Year P.G. Program in Computer Science & Engineering

1. COMPUTER LAB-I

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<th>Teaching Scheme</th>
<th>PR: 4</th>
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<th>Termwork</th>
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Computer Lab – I shall be based on the subjects Data Structures & Algorithm and Advanced Computer Networks.

**Term Work:**
The Term Work shall consist of at least 8 programs/assignment or one small project for each subject. The experiments shall be evenly spread over the entire syllabus.

2. COMPUTER LAB-II

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<th>Termwork</th>
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Computer Lab – II shall be based on the subjects Advanced Database Management Systems and Elective – I.

**Term Work:**
The Term Work shall consist of at least 8 programs/assignment or one small project for each subject. The experiments shall be evenly spread over the entire syllabus.
First Year P.G. Program in Computer Science & Engineering

1. Advanced Operating System

Teaching Scheme | L: 4 | Theory | Test | Minimum Passing Marks
--- | --- | --- | --- | ---
Evaluation Scheme | 100 Marks | 25 Marks | 40%

Course Objectives
- To familiarize with the goals, components and architecture of operating systems.
- To study process, thread, memory and disk management techniques.
- To do comparative study between Linux and windows kernels.

UNIT I (4 Hrs)

UNIT II (5 Hrs)

UNIT III (8 Hrs)

UNIT IV (8 Hrs)
UNIT V


UNIT VI


Text Books:


Reference Books:

First Year P.G. Program in Computer Science & Engineering

2. Advanced Compiler Design

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Course Objectives

- An introduction to advanced topics in compiler design is given.
- It also provides the concepts of code analysis, optimization techniques and code scheduling in Compiler design.

UNIT I


UNIT II


UNIT III


UNIT IV

Dependence Analysis and Dependence Graphs: Dependence Relations, Basic-Block Dependence DAGs, Dependences in Loops, Dependence Testing, Program-Dependence Graphs.

UNIT V

Redundancy Elimination: Common-Subexpression Elimination, Loop-Invariant Code Motion, Partial-Redundancy Elimination, Redundancy Elimination and Reassociation, Code Hoisting
UNIT VI

(6 Hrs)

Loop optimization: Induction-Variable Optimizations, Unnecessary Bounds-Checking
Elimination
Register Allocation: Register Allocation and Assignment, Local Methods, Graph
Coloring, Priority-Based Graph Coloring
Instruction Scheduling: branch scheduling, list scheduling.

Text Books:

1. Advanced Compiler Design and Implementation, by Steven Muchnick, Publisher:
   978-1558603202.

Reference Books:

   Wesley, 1986
2. Engineering a Compiler, by Keith Cooper and Linda Torczon, Publisher: Morgan
   Kaufmann, ISBN: 9780120884780
3. *Optimizing Compilers for Modern Architectures*, by Randy Allen & Ken Kennedy,
   Publisher: Morgan Kaufmann, ISBN: 9781558602861
3. Object Oriented Software Engineering

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Course Objectives

- To learn the concepts of Software Engineering.
- To understand Software Development Life Cycle.
- To know design & testing principles of software project development.

Course Contents

UNIT I (8 Hrs)

The scope of software engineering, software life-cycle models, the software process, software metrics, non-execution based testing; execution based testing, modules, cohesion, coupling, data encapsulation, abstract data types, information hiding, objects, inheritance, polymorphism, and dynamic binding, the object-oriented paradigm, reusability and portability.

UNIT II (4 Hrs)

Requirements: overview of requirements workflow, understanding the domain, the business model, initial requirements, classical requirement phase, rapid prototyping, CASE tools for requirements workflow, challenges of the requirements workflow.

UNIT III (8 Hrs)

Classical analysis: specification document, informal specifications, structured system analysis, other semiformal techniques, Entity-relationship modeling, finite state machines, Petri nets, Zed, other formal techniques, testing during classical analysis, CASE tools for classical analysis, challenges of classical analysis.

UNIT IV (6 Hrs)

Object-oriented analysis: The analysis workflow, extracting the entity classes, functional modeling, entity class modeling, dynamic modeling, extracting the boundary and control classes, CASE tools for object-oriented analysis workflow, challenges of the object-oriented analysis workflow.
UNIT V (6 Hrs)

Design: Design & abstraction, operation-oriented design, data flow analysis, transaction analysis, data oriented design, object oriented design, the design workflow, formal techniques for detailed design, real-time design techniques, CASE tools for design, challenges of the design workflow.

UNIT VI (8 Hrs)

Implementation - choice of programming language, 4th generation language, good programming practice, coding standards, code reuse. Integration – top down, bottom up, sandwich integration, integration of object-oriented products, management of integration. Test case selection, black-box unit testing techniques, glass-box unit testing techniques, code walkthrough and inspections, integration testing, product testing, acceptance testing, CASE tools for implementation, challenges of the implementation workflow, postdelivery maintenance

Text Books:


Reference Books:

4. Advanced Computer Architecture

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Course Objectives:

- To introduce the fundamental techniques on which high-performance computing is based, to develop the foundations for analyzing the benefits of design options in computer architecture.
- Explore advanced concepts and state-of-the-art developments in computer architecture: memory systems, pipelining, relationship between computer design and application requirements, cost/performance tradeoffs, and many example computers of interesting and unusual features.
- The principles, characteristics, and trends of computer systems design at a level appropriate for all computer scientists and computer engineers.

Course Contents

UNIT I (8 Hrs)

Instruction Level Parallelism
ILP – Concepts and challenges – Hardware and software approaches – Dynamic scheduling – Speculation - Compiler techniques for exposing ILP – Branch prediction.

UNIT II (8 Hrs)

Multiple Issue Processors
VLIW & EPIC – Advanced compiler support – Hardware support for exposing parallelism – Hardware versus software speculation mechanisms – IA 64 and Itanium processors – Limits on ILP.

UNIT III (8 Hrs)

Multiprocessors and Thread Level Parallelism
UNIT IV

Memory And I/O

UNIT V

Multi-Core Architectures

Text Books:


Reference Books:

First Year P.G. Program in Computer Science & Engineering

**ELECTIVE-II**

1. Cryptography & Network Security

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>L: 4</th>
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<tr>
<td>Evaluation Scheme</td>
<td>Theory</td>
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<td></td>
<td>100 Marks</td>
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</table>

**Course Objectives**

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption
- To understand authentication and Hash functions.
- To know the network security tools and applications.
- To understand the system level security used.

**Course Contents**

**UNIT I**

8 Hrs

**Symmetric Ciphers**
Security Attacks, Services and Mechanisms, Classical Encryption Techniques, DES, Triple DES, AES, IDEA, CAST, Blowfish, RC6, Characteristics of Advanced Symmetric Block Ciphers, Block Cipher Modes of operations, Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

**UNIT II**

6 Hrs

**Asymmetric Ciphers**
Principles of Public Key Cryptography, RSA Algorithm, Rabin Algorithm, ElGamal Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

**UNIT III**

8 Hrs

**Message Authentication & Hash Functions**
UNIT IV (6 Hrs)

Key Distribution & User Authentication
Symmetric key distribution, public key distribution, X.509 certificates, public-key infrastructure, remote user authentication, Kerberos, federated identity management

UNIT V (8 Hrs)

Network & Internet security

UNIT VI (6 Hrs)

System Security
Intruders, Intrusion detection, Password management, malicious software, Viruses and related threats, Virus countermeasures, Distributed denial of service attacks, Fire walls: Firewall design principles, trusted systems.

Text Books:

Reference Books:
First Year P.G. Program in Computer Science & Engineering

ELECTIVE-II
2. Distributed Computing

Teaching Scheme L: 4

Evaluation Scheme Marks
Theory 100 Marks Test 25 Marks Minimum Passing 40%

Course Objectives

- To understand the concepts of distributed environment and the key areas of Distributed Application Development.
- Explore the issues involved in distributed multimedia systems and Ubiquitous Computing.
- Familiarize with CORBA

Course Contents

UNIT I (6 Hrs)

UNIT II (8 Hrs)
UNIT III (10 Hrs)
Operating System Support: Introduction, The operating system layer, Protection, Processes and threads, Communication and invocation, operating system architecture, Virtualization at the operating system level. Distributed Objects and components: Introduction, Distributed objects, case study: CORBA, From objects to components, Case studies: Enterprise Javabeans and Fractal. Web Services: Introduction, Web services, Service descriptions and IDL for web services, a directory service for use with web services, XML security, Coordination of web services, Application of web services.

UNIT IV (8 Hrs)

UNIT V (8 Hrs)

Textbook:

Reference Books:
First Year P.G. Program in Computer Science & Engineering

ELECTIVE-II
3. Data Mining and Data Warehousing

Teaching Scheme

<table>
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<td>100 Marks</td>
<td>25 Marks</td>
<td>40%</td>
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Course Objectives

- To get the sound understanding of the foundations of data mining.
- To learn the advanced topics such as web mining, search engines, etc.
- To explore the various data mining algorithms by using case studies.

Course Contents

UNIT I (4 Hrs)

Data Warehouse and OLAP Technology: An Overview, What Is a DataWarehouse?, A Multidimensional Data Model, DataWarehouse Architecture, DataWarehouse Implementation, Case Study.

UNIT II (7 Hrs)

Data Mining Fundamentals
Introduction, What Is Data Mining? Data Mining—On What Kind of Data, DM Functionalities, Are All of the Patterns Interesting?, Classification of DM Systems, DM Task Primitives, Integration of a DM with a DBMs or DW System, Major Issues in DM. Data Preprocessing: Why Preprocess the Data, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT III (8 Hrs)

Classification
UNIT IV (8 Hrs)

Association Analysis
Basic Concepts and Algorithms: Problem Definition, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, FP-Growth Algorithm, Handling Categorical Attributes, Handling Continuous Attributes, Handling a Concept Hierarchy, Sequential Patterns, Subgraph Patterns. Case Study.

UNIT V (8 Hrs)

Cluster Analysis

UNIT VI (7 Hrs)

Web Data Mining

Text Books:


Reference Books:

First Year P.G. Program in Computer Science & Engineering

**ELECTIVE-II**

**4. Computer Vision**

<table>
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Course Objectives

- This course introduces students to basic concepts and techniques in computer vision.
- Students will be able to apply a variety of computer techniques for the design of efficient algorithms for real-world applications, such as optical character recognition, face detection and recognition, motion estimation, human tracking and gesture recognition.

**UNIT I**

**(4 Hrs)**

**Image Formation**


**UNIT II**

**(8 Hrs)**

**Motion Analysis**

Differential motion analysis methods, Optical flow: Optical flow computations, Global and local optical flow estimation, Optical flow computation approaches, Optical flow in motion analysis, Analysis based on correspondence of interest points: Detection of Interest points, Correspondence of interest points, Object tracking, Kalaman filters, Motion Understanding: Domain-Independent understanding, Domain-dependent understanding, Stereovision

**UNTI III**

**(8 Hrs)**

**Shape Representation and Description**

Deformable curves and surfaces, Snakes and active contours, Region Identification, Contour-based shape representation and description: chain code, simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, B-spline representation, Other contour-based shape description approaches, Shape invariants, Region-based shape representation and description: Simple scalar region descriptors, Moments, Convex hull, Graph representation based on region skeleton, Region decomposition, Region neighborhood graphs, Shape classes
UNIT IV  

Texture  
Statistical texture description: Methods based on spatial frequencies, Co-occurrence matrices, Edge frequency, Primitive length (run length), Laws texture energy measures, Fractal texture description, Other statistical methods of texture description, Syntactic texture description methods: Shape chain grammars, Graph grammars, Primitive grouping in hierarchical textures, Hybrid texture description methods, Texture recognition method applications

UNIT V  

Object Recognition  
Hough transforms and other simple object recognition methods, Knowledge representation, Statistical pattern recognition: Classification principles, Classifier setting, Classifier learning, cluster analysis, Neural Nets: Feed-forward networks, Unsupervised learning, Hopfield neural nets, Syntactic Pattern Recognition: Grammars and languages, Syntactic analysis, Syntactic classifier, Syntactic classifier learning, Grammar inference, Recognition as Graph Matching: Isomorphism of graphs and sub-graphs, Similarity of graphs

UNIT VI  

Optimization Techniques in Recognition and Tracking  

Reference Books:

First Year P.G. Program in Computer Science & Engineering

ELECTIVE-II
5. Pattern Recognition

<table>
<thead>
<tr>
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Course Objectives

The objective of this course is to enable the students to understand the fundamentals of
- Pattern recognition. The students should learn to choose an appropriate feature.
- Pattern classification algorithm for a pattern recognition problem, properly implement the algorithm using modern computing tools such as Matlab, Open CV, C, C++ and correctly.
- Analyze, and report the results using proper technical terminology

Course Contents

UNIT I (6 Hrs)
Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

UNIT II (6 Hrs)
Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

UNIT III (6 Hrs)
Maximum-Likelihood And Bayesian Parameter Estimation: Introduction; maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT IV (6 Hrs)
Non-Parametric Techniques: Introduction; Density Estimation; Parzen windows; kn Nearest-Neighbor Estimation; The Nearest-Neighbor Rule; Metrics and Nearest-Neighbor Classification.
UNIT II

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Nonseparable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

UNIT VI

Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

Reference Books:

First Year P.G. Program in Computer Science & Engineering

1. COMPUTER LAB-III

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>PR: 4</th>
<th>Practical</th>
<th>Termwork</th>
<th>Minimum Passing Marks</th>
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<td>Evaluation Scheme</td>
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<td>25 Marks</td>
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Computer Lab – III shall be based on the subjects Advanced Operating Systems and Object Oriented Software Engineering.

Term Work:
The Term Work shall consist of at least 8 programs/assignment or one small project for each subject. The experiments shall be evenly spread over the entire syllabus.

2. COMPUTER LAB-IV

<table>
<thead>
<tr>
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<td>25 Marks</td>
<td>25 Marks</td>
<td>40%</td>
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</table>

Computer Lab – IV shall be based on the subjects Advanced Compiler Design and Elective – II.

Term Work:
The Term Work shall consist of at least 8 programs/assignment or one small project for each subject. The experiments shall be evenly spread over the entire syllabus.
**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, VISHNUPURI, NANDED.**

Curriculum and scheme of Examination of M.E. program in Computer Science and Engineering

M.E. (CSE) Second Year

**SEMESTER - III**

<table>
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<td>Practical</td>
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<td>Dissertation Part - I</td>
<td>-</td>
<td>20*</td>
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</tbody>
</table>

* This is the minimum number of hours student should work for his/her dissertation; however the teaching load for guide is 4Hrs / student / week.

**SEMESTER - IV**

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<tr>
<td>01</td>
<td>Dissertation Part - II</td>
<td>-</td>
<td>20*</td>
</tr>
</tbody>
</table>

* This is the minimum number of hours student should work for his/her dissertation; however the teaching load for guide is 2Hrs / student / week.

Dissertation shall consist of research work done by the candidates in the areas related to Computer Science & Engineering.

**OR**

Design and/or development of a software (product) related to Computer Science & Engineering.
Following shall be the guidelines for the evaluation of dissertation part – I

**Dissertation Part – I**

1. Dissertation part – I shall consist of the following components (whichever applicable)
2. Extensive literature survey.
3. Data collection from R & D organizations, Industries, etc.
5. Detailed design (H/W and S/W as applicable).
6. Partial Implementation, etc.

A candidate should prepare the following documents for the examination

1. A term paper in the IEEE format based on the work.
2. A detailed report of the work done by the candidate related to dissertation.

Every candidate should present himself (for about 30 min) before the panel of examiners (which will evaluate the dissertation-I for term work and oral marks) consisting of

1. Head of the Department.
2. M.E. Coordinator.
3. All guides.
4. At least one examiner from outside the Department.

**Dissertation Part – II**

The dissertation shall be assessed internally by a panel of examiners before submission to the University. The candidate shall submit the dissertation in triplicate to the Head of the Institution, duly certified that the work has been satisfactorily completed. The practical examination (viva-voce) shall consists of a defense presented by the candidate in the presence of Examiners appointed by the University one of whom will be the guide and the other an External Examiner.