# First Year PG Program in Computer Science and Engineering
## Semester-I

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Group</th>
<th>Teaching Scheme</th>
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**Total** 17 6 8 31 28

**Group Details**
- **A:** Basic Science
- **B:** Engineering Science
- **C:** Humanities Social Science & Management
- **D:** Professional Courses & Professional Elective
- **E:** Free Elective
- **F:** Seminar/Training/Project

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**CSL51* - Elective I**

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<td>CSL506</td>
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**CSL52* - Elective II**

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<td>CSL509</td>
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**CSL53* - Elective I Lab**

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First Year M.Tech.
CSL501: Mathematical Foundation of Computer Science

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Course Objectives

1. To enhance the problem solving skills in the areas of theoretical computer science.
2. To use the mathematical concepts in the development of computer applications.
3. To make the student aware of mathematical tools, formal methods & automata techniques to computing.
4. To strengthen the students’ ability to carry out formal and higher studies in computer science.

Course Outcomes

At the end of the course students will be able to

1. Use mathematical concepts in the development of language design.
2. Design regular expressions and automata for different language classes.
3. Design context free grammar and push down automata for different applications.
4. Describe different types of Turing Machine their use, capability, and limitations.
5. Determine decidability and reducibility of computational problems.
6. Determine Computability and Computational Complexity.

Course Contents

Unit 1. Introduction
Mathematical notions and terminology of sets, sequences and tuples, functions and relations, graphs, strings and languages, Boolean logic – properties and representation, Definition, Theorems and Types of Proofs – Formal proofs, deductive, reduction to definition, proof by construction, contradiction, induction, counter-examples.

7 Hrs.

Unit 2. Regular Languages
Finite automata, DFA, NFA, Equivalence of DFA & NFA. An application, Regular expressions and languages, applications

7 Hrs.
Unit 3.  **Context free languages**  
CFGs, Applications, Ambiguity removal, pushdown automata and Equivalence with CFGs.

6 Hrs.

Unit 4.  **Turing Machine**  
Turing machines, variants of TMs, non-deterministic Turing machine, universal Turing machine, programming techniques for TMs, Restricted TMs, TMs and Computers

7 Hrs.

Unit 5.  **Decidability and Reducibility**  

8 Hrs.

Unit 6.  **Computability and Computational Complexity**  
Primitive recursive functions, computable functions, examples, the recursion theorem. Tractable and Intractable problems – Growth rates of function, time complexity of TM, tractable decision problems, theory of Optimization.

7 Hrs.

Reference Books

1. *Introduction to Theory of Computation* – Michael Sipser (Thomson Nrools/Cole)
3. *Introduction to languages and theory of computation* – John C. Martin (MGH)
5. *Theory of Computer Science* – E. V. Krishnamoorthy
First Year M. Tech.
CSL502: Design and Analysis of Algorithms

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Course Objectives
1. To provide solution to problems using different algorithm design paradigms.
2. To analyse performance of algorithms and find lower bound.
3. To synthesize algorithms for different parallel architectures.

Course Outcomes
At the end of the course students will be able to
1. Discover solution to problems using different algorithm design paradigms like Divide and Conquer and Greedy Approach.
2. Apply dynamic programming approach to tackle problems.
3. Analyse performance of algorithms using asymptotic analysis.
4. Find lower bound of complexity to solve different problems.
5. Synthesize efficient algorithms for different parallel architectures.

Course Contents
Unit 1. Divide and Conquer and Greedy Method 8 Hrs.
Algorithm basics, Performance Analysis, Recurrence relations.
Divide and Conquer- The general method, Binary search, finding the maximum and minimum, Merge sort, Quick sort, Analysis of algorithms designed. Greedy Method- The general method, Knapsack problem, Job sequencing with deadlines, minimum-cost spanning trees – Prim’s and Kruskal’s Algorithms, Optimal merge patterns, Single source shortest paths, Analysis of algorithms designed.
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<th>Unit 2.</th>
<th><strong>Dynamic Programming</strong></th>
<th>7 Hrs.</th>
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<td>The general method, Multistage graphs, All pair shortest paths, Optimal binary search trees, 0/1 knapsack, Reliability design, Traveling Salesperson problem, Flow shop scheduling, Analysis of algorithms designed.</td>
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<th>Unit 3.</th>
<th><strong>Lower Bound Theory and NP Hard, NP Complete Problems</strong></th>
<th>8 Hrs.</th>
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<td>Lower Bound Theory- Comparison trees, Oracles and adversary arguments, Lower bounds through reductions.NP Hard and NP Complete Problems - Basic Concepts, Cook’s Theorem, NP Hard Graph Problems, NP Hard Scheduling Problems, NP-Hard Code Generation Problems</td>
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<th>Unit 4.</th>
<th><strong>Approximation Algorithms</strong></th>
<th>6 Hrs.</th>
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<td>Introduction, Absolute approximations, ( \varepsilon )- approximations, Polynomial time approximation Schemes, Fully Polynomial Time Approximation Schemes, Probabilistically Good Algorithms.</td>
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<th>Unit 5.</th>
<th><strong>PRAM and MESH Algorithms</strong></th>
<th>7 Hrs.</th>
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<th>Unit 6.</th>
<th><strong>HYPERCUBE and BUTTERFLY Algorithms</strong></th>
<th>6 Hrs.</th>
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<td>Computational Model, PPR Routing, Fundamental Algorithms, Selection, Merging, Sorting, Graph Problems.</td>
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**Reference Books**

2. The Design and Analysis of Computer Algorithms – Aho, Hopcraft & Ulman (Pearson Education)
First Year M. Tech.
CSL503: Service Oriented Architecture

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Course Objectives
1. To provide an overview of XML Technology and modeling databases in XML.
2. To provide an overview of Service Oriented Architecture and Web services and their importance.

Course Outcomes
At the end of the course students will be able to
1. Model XML databases.
2. Create web services.
3. Make web services secure.

Course Contents

Unit 1. XML Technology

Unit 2. SOA Basics
### Unit 3. Web Services (WS)

### Unit 4. SOA Implementation

### Unit 5. WS Technologies and Standards

### Unit 6. XML and WS Security

### Reference Books
First Year M. Tech.
CSL504: Business Intelligence and Data Mining

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Course Objectives
1. Introduce the students with business intelligence tasks.
2. To study pattern mining techniques.
3. To study the basics of web mining.
4. To study & implement pattern mining techniques.
5. To study & implement the web mining’s pre-processing.

Course Outcomes
At the end of the course students will be able to
1. Recognize the need for business intelligence to support business management.
2. Understand and apply data mining techniques to data set.
3. Familiar with leading data mining software
4. Know the importance of B.I. applications.
5. Describe dimensional Modeling and designing.

Course Contents

Unit 1. Introducing the Technical Architecture 6 Hrs.

Unit 2. Introducing Dimensional Modeling and designing 7 Hrs.
## Unit 3. Introducing Extract, Transformation & Load
Round up the requirements, the 34 subsystems of ETL, Extracting Data, Cleaning & Conforming data.

6 Hrs.

## Unit 4. Introducing Business Intelligence Applications and Designing & Developing

8 Hrs.

## Unit 5. Web Mining and social network analysis

9 Hrs.

## Unit 6. Mining Stream, Time-Series, and Sequence Data
Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data.

6 Hrs.

### Reference Books
1. The Data Warehouse Lifecycle Toolkit By Raiph Kimball, Ross, 2nd edition, Wiley Publication
3. Data Mining: Introductory and Advanced Topics, M.H. Dunham, Pearson Education
5. Data Warehousing Fundamentals – Ponniah [Wiley Publication]
6. Introduction to Business Intelligence & Data Warehousing, IBM, PHI.
7. Business modeling and Data Mining Dorian Pyle, Elsevier Publication MK.
First Year M. Tech.  
CSL505: Advanced Software Engineering

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Course Objectives
1. To understand the essentials of component-based software engineering.
2. To understand the essentials of client/server software engineering
3. To understand the basics of web engineering
4. To know principle of reengineering.

Course Outcomes
At the end of the course students will be able to
1. Understand the essentials of component-based software engineering.
2. Understand the essentials of client/server software engineering
3. Understand the basics of web engineering
4. Know principle of reengineering.
5. Study and Use the software engineering tools

Course Contents
Unit 1. Formal Methods 8 Hrs.

Unit 2. Component-Based Software Engineering 7 Hrs.
Engineering of Component-Based Systems, The CBSE Process, Domain Engineering, Component-Based Development, Classifying and Retrieving Components, Economics of CBSE.
Unit 3. **Client/Server Software Engineering**  
7 Hrs.


Unit 4. **Web Engineering**  
8 Hrs.


Unit 5. **Reengineering**  
5 Hrs.


7 Hrs.

**Reference Books**

First Year M. Tech.
CSL506: Visualization Techniques

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**Course Objectives**
1. An understanding of the key techniques and theory used in visualization.
2. Exposure to a number of common data domains and including multivariate data, graph, text.
3. To know about Effective Visualizations.

**Course Outcomes**
At the end of the course students will be able to
1. Understand key techniques and theory used in visualization
2. Exposure to a number of common data domains and including multivariate data, graph, text.
3. Know about Effective Visualizations.
4. Introduction to available visualization software.
5. Implementation any Data pre-processing technique.

**Course Contents**

**Unit 1.** What is Visualization, the visualization process, Data Foundations, types of data – continuous data, sampled data, discrete datasets, Human Perception and Information Processing, Visualization Foundations.  
7 Hrs.

**Unit 2.** Visualization Techniques for Spatial Data: 1D, 2D and 3D, Dynamic Data, Geospatial Data, Visualizing Point, Line and Area Data, Visualization Techniques for Multivariate Data, Visualization Pipeline.  
7 Hrs.

9 Hrs.
Unit 4. Scientific Visualization: Scalar, Vector, Tensor Visualization, Domain Modeling Technique, Image and Volume Visualization 6 Hrs.


Unit 6. Designing Effective Visualizations, Steps in Designing Visualizations, Problems in Designing Effective Visualizations 6 Hrs.

Reference Books

1. Interactive Data Visualization: Foundations, Techniques, and Applications (AK Peters) by Matthew O. Ward, Georges Grinstein and Daniel Keim
4. Visualization Design and Analysis: Abstractions, Principles, and Methods by Tamara Munzner
Teaching Scheme

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Evaluation Scheme

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Course Objectives
1. To introduce student to various Pattern recognition techniques
2. To study the Representation and description and feature extraction
3. To study the principles of decision trees and clustering in pattern recognition.

Course Outcomes
At the end of the course students will be able to
1. Develop algorithms for Pattern Recognition.
2. Design the nearest neighbour classifier.
3. Develop and analyse decision trees.

Course Contents

Unit 1. Introduction: 8 Hrs.
Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

Unit 2. Representation: 8 Hrs.
Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

Unit 3. Nearest Neighbour based classifiers: 7 Hrs.
Nearest neighbour algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection.
Unit 4. **Bayes classifier:**
Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.

Unit 5. **Decision Trees:**
Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

Unit 6. **Clustering:**
Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy’s, k-means, Isodata), clustering large data sets, examples.

**Reference Books**
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI
First Year M.Tech.
CSL508: High Performance Computer Architectures

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Course Objectives
1. Introduce types of computer architectures.
2. Introduce concepts of Memory Hierarchy and latency.
3. Instruction Level Parallelism.
4. Study of Data-Level Parallelism in Vector, SIMD, and GPU Architectures.
5. Study of Warehouse-Scale Computers.

Course Outcomes
At the end of the course students will be able to
1. Explain different computer architectures.
2. Describe memory hierarchy and calculate memory latency.
3. Explain instruction level parallelism and its exploitation
4. Explain vector, SIMD and GPU architectures.
5. Describe thread level parallelism.
6. Explain warehouse-scale computer architecture.

Course Contents

Unit 1. **Fundamentals of Quantitative Design and Analysis**

Unit 2. **Memory Hierarchy Design**
Introduction, Ten Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Protection: Virtual Memory and Virtual Machines, Crosscutting Issues: The Design of Memory Hierarchies, Putting It All Together: Memory Hierarchies in the ARM Cortex-A8 and Intel Core I7, Fallacies and Pitfalls.
Unit 3. **Instruction-Level Parallelism and Its Exploitation**

Instruction-Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazards with Dynamic Scheduling, Dynamic Scheduling: Examples and the Algorithm, Hardware-Based Speculation, Exploiting ILP Using Multiple Issue and Static Scheduling, Exploiting ILP Using Dynamic Scheduling, Multiple Issue, and Speculation, Advanced Techniques for Instruction Delivery and Speculation, Studies of the Limitations of ILP Cross-Cutting Issues: ILP Approaches and the Memory System, Multithreading: Exploiting Thread-Level Parallelism to Improve Uniprocessor Throughput, Putting It All Together: The Intel Core i7 and ARM Cortex-A8 233 Fallacies and Pitfalls.

Unit 4. **Data-Level Parallelism in Vector, SIMD, and GPU Architectures**

Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units Detecting and Enhancing Loop-Level Parallelism, Crosscutting Issues, Putting It All Together: Mobile versus Server GPUs and Tesla versus Core i7, Fallacies and Pitfalls.

Unit 5. **Thread-Level Parallelism**

Introduction, Centralized Shared-Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors, Distributed Shared-Memory and Directory-Based Coherence, Synchronization, Models of Memory Consistency, Crosscutting Issues, Putting It All Together: Multicore Processors and Their Performance, Fallacies and Pitfalls.

Unit 6. **Warehouse-Scale Computers to Exploit Request-Level and Data-Level Parallelism**


Reference Books

**First Year M.Tech.**  
**CSL509: Computer Vision**

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**Course Objectives**

1. Introduce basic image operations.
2. Study of Image Thresholding and edge detection techniques.
3. Corner and interest point detection methods.
4. Binary Shape analysis
5. Fundamental vision operation like line, circle and ellipse detection.

**Course Outcomes**

At the end of the course students will be able to

1. Write algorithms for basic image processing operations.
2. Write algorithms for Thresholding and edge detection.
3. Explain corner and interest point detection methods
4. Explain methods for binary shape analysis.
5. Write algorithm for line detection and boundary analysis
6. Write algorithm for line and circle detection.

**Course Contents**

**Unit 1. Low-Level Vision- Basic Image Operations**

8 Hrs.

D. K. T. E. Society's Textile and Engineering Institute, Ichalkaranji
Department of Computer Science and Engineering

Mode, Shifts Introduced by Mean and Gaussian Filters, Shifts Introduced by Rank Order Filters, Shifts in Rectangular Neighbourhoods, The Role of Filters in Industrial Applications of Vision Colour in Image Filtering.

Unit 2. Low-Level Vision- Thresholding and Edge detection

8 Hrs.

Unit 3. Corner and Interest Point Detection

8 Hrs.

Unit 4. Binary Shape Analysis
Connectedness in Binary Images, Object Labeling and Counting, Solving the Labelling Problem in a More Complex Case, Size Filtering, Distance Functions and Their Uses, Local Maxima and Data Compression, Skeletons and Thinning, Crossing Number, Parallel and Sequential Implementations of Thinning, Guided Thinning, A Comment on the Nature of the Skeleton, Skeleton Node Analysis, Application of Skeletons for Shape Recognition, Other Measures for Shape Recognition, Boundary Tracking Procedures

6 Hrs.

Unit 5. Boundary Pattern Analysis and Line Detection
Boundary Tracking Procedures, Centroidal Profiles, Problems with the

6 Hrs.
Unit 6. **Circle and Ellipse Detection**  
6 Hrs

Hough-Based Schemes for Circular Object Detection, The Problem of Unknown Circle Radius, The Problem of Accurate Center Location, Overcoming the Speed Problem, Ellipse Detection, Human Iris Location, Hole Detection.

**Reference Books**

First Year M.Tech.
CSL510: Research Methodology

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Course Objectives
1. To familiarise students with the dimensions and methods of research.
2. To familiarise students with different methods of data collection.
3. Give students an insight into the steps to be followed in doing a research

Course Outcomes
At the end of the course students will be able to
1. Understand the dimensions and methods of research.
2. Use appropriate method for data collection.
3. Perform research by following research process steps systematically.

Course Contents

Unit 1. Fundamentals of Research
Introduction, Concepts of Research, Research Process, Creativity in Research, Ethics in Research, Managers and Research

Unit 2. Research Problem
Introduction, Concept of Research Problem, Conditions and Components of Research Problem

Unit 3. Research Design
Introduction, Concept of Research Design, Need and Features of Research Design, Components of Research Design, Types of Research Design

Unit 4. Methods of Data Collection
Concepts of Data Collection, Types of Data, Methods of Primary Data Collection, Some other Methods of Primary Data Collection, Methods of Secondary Data Collection, Selecting an Appropriate Method of Data Collection

4 Hrs.
4 Hrs.
4 Hrs.
6 Hrs.
Unit 5. **Data Processing and Analysis**  
6 Hrs.
Introduction, Concepts of Data Processing, Concept of Data Analysis, Measures of Central Tendency, Measures of Dispersion, Measures of Skewness, Measures of Relationship, Other Statistical Measures used in Research

Unit 6. **Computer Application in Research Methodology**  
4 Hrs.
Introduction, Computer Application in Research Methodology, SPSS Software, Descriptive Statistics, Bivariate Statistics, Regression Analysis

**Reference Books**

1. Research Methodology by G.C. Ramamurthy & Kogent Learning Solutions Inc. (dreamtech press)
First Year M.Tech.
CSP511– Design and Analysis of Algorithms Lab

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List of Experiments
1. Demonstration of use of profiler.
2. Implementation of binary search and its analysis.
3. Write efficient algorithm to find minimum and maximum of given numbers.
4. Implementation of Merge Sort and its analysis.
5. Implementation of Quick Sort and its analysis.
6. Write program to find single source shortest path.
7. Implementation of Prim’s and Kruskal’s algorithm to find minimum cost spanning tree.
8. Implementation of Huffman coding.
9. Write program to give solution to Knapsack Problem.
10. Write program to give solution to Job sequencing with deadlines problem.
11. Write program to give solution to multistage graph problem.
12. Write program to give solution to all pair shortest path problem.
13. Write program to find Optimal Binary Search Tree.
14. Write program to give solution to Reliability design problem.
First Year M.Tech.
CSP512– Service Oriented Architecture Lab

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| Total Credits          | 100               |

List of Experiments

1. Demonstration of Web Services.
2. Invoke EJB components as web services.
3. Invoking J2EE web service in ASP.Net using C#.
4. Invoking ASP.Net web service using J2EE.
5. Implementation of CORBA.
6. Develop a j2ee client to access a .net web service.
7. Develop a .net client to access a j2ee web service.
8. To implement calculator and to calculate simple and complex interest using .net.
9. To develop an invoice order processing using .net components.
10. Creation of a bpel module and a composite application.
Teaching Scheme

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Evaluation Scheme

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| Total | 50 |

List of Experiments

It should consist of minimum 8-10 experiments based on the following and syllabus topics.

1. Implement of preprocessing on sample dataset.
2. Implementation of cube operator in OLAP queries in data warehousing and decision support system.
3. Implement apriori algorithm in data mining for sample dataset.
4. Implement association rule mining for sample dataset.
5. Implement sequence mining for sample dataset.
6. Implement web usage mining algorithm.
7. Implement data pre-processing for server log files.
8. Study of data mining tools like weka.
First Year M.Tech.  
CSL5014– Advanced Software EngineeringLab

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**List of Experiments**

Practical: It should consist of minimum 8-10 experiments based on the following and syllabus topics.

1. Use case tools for analyzing and designing software
2. Using rational rose draw all diagrams to be drawn for small sample software.
3. A Case study for UML diagrams.
5. Study of any web testing tool (e.g. Selenium).
6. Study of Any Bug Tracking Tool (Bugzilla, Bugbit).
7. Study of Any Test Management Tool (Test Director).
8. Study of any open source testing tool (Test Link).
9. Identifying the Requirements from Problem Statements
10. Estimation of Project Metrics
11. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
12. E-R Modeling from the Problem Statements
13. Identifying Domain Classes from the Problem Statements
First Year M.Tech.
CSL515– Visualization Techniques Lab

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List of Experiments
Practical:
It should consist of minimum 8-10 experiments based on the following and syllabus topics.
1. Prepare data files for data mining.
2. Study of weka tool.
3. Implement any Data preprocessing technique
4. Study of following visualization tools.
   - **Xmdvtool** (a multivariate visualization tool, Windows)
     Xmdvtool Home Page for help
   - **OpenDX** (open interactive visualization software also from IBM, Windows)
     OpenDX Complete documentation
   - **GGobi** (interactive tool for multivariate data viz), Windows
   - **Protovis** visualizations implemented in Javascript (Stanford University)
     Protovis is superceeded by **D3** and tutorials
   - **Graphviz** (graph layout algorithms, Windows)
   - **Prefuse** (toolkit for building Java viz applications)
   - **OpenRefine**, formerly Google Refine, is a desktop application with algorithms to seek similarities in data records. Other features make it easier to do various types of data editing and clustering. You can also compare entries in your data with items in another database to standardize records, as long as the reference database has a Reconciliation Service API. Possible reconciliation databases include [OpenCorporates](http://www.opencorporates.com) and [Freebase](http://www.freebase.com).
   - Google Chart Tools. Find it at: [https://developers.google.com/chart/](https://developers.google.com/chart/)
   - **Quantum GIS (QGIS)** An open source alternative to ArcGIS. Get it: [http://www.qgis.org](http://www.qgis.org)
   - **R Project for Statistical Computing** R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS.
   - **Processing**
     A free, open source programming language and environment. Allows for rapid prototyping of visual, interactive programs.
   - **Data-Driven Documents (d3)**
A free, small Javascript library well suited for interactive data visualization on the web.

- **Many Eyes**
  A free online visualization tool that allows users to upload data, select a visualization technique, and share the resulting visualization. Provided by IBM Research and the IBM Cognos software group.

- **Tableau Public**
  A free service allowing users to publish interactive data visualizations to the web.

**Visualizing.org**
A website that allows users to create and share visualizations, and hosts datasets and visualization challenges.

5 Create web-based interactive visualizations using Java and D3.
6 Use Java and other tools to scrape, clean, and process data.
First Year M. Tech.
CSS516: Seminar-I

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Each student is required to do a seminar presentation on a topic preferably from the area in which a student intends to work for his dissertation during Semester – III and Semester – IV. Preparation and presentation of a seminar is intended to investigate an in-depth review of literature, prepare a critical review and develop confidence to present the material by the student. The seminar shall be evaluated by a Department Committee constituted for this purpose, based on a report submitted by the candidate and a viva-voce conducted at the end of the semester.
**First Year PG Program in Computer Science and Engineering**

**Semester-II**

<table>
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<tr>
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**Group Details**

A: Basic Science  
B: Engineering Science  
C: Humanities Social Science & Management  
D: Professional Courses & Professional Elective  
E: Free Elective  
F: Seminar/Training/ Project

**CSL54* - Elective III**

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**CSL55* - Elective IV**

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**CSP56* - Elective III Lab**

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Course Objectives
1. To understand network protocols, architectures and applications
2. To study the functionality of various layers of the OSI model / TCP/IP model and understand the interactions between them
3. To Study description of the various Routing in the Internet and the working of ATM.
4. To understand the networking management principals

Course Outcomes
At the end of the course students will be able to
1. Understand network protocols, architectures and applications.
2. Understand the functionality of various layers of the OSI model / TCP/IP model and understand the interactions between them
3. Describe various Routing in the Internet and the working of ATM.
4. Understand the networking management principals.
5. Use various tools and utilities of networking

Course Contents
Unit 1. Introduction 14 Hrs.
Protocols and standards, Standards Organizations, Internet Standards, Internet Administration, Overview of reference models : The OSI model, TCP/IP protocol suite, Addressing, Connectors, Network interface cards and PC cards, Repeaters, Hubs, Bridges, Switches, Routers and Gateway, Network architecture, Networking principles, Network services and Layered architecture, e.g. networks (Internet, ATM, Cable TV, Wireless – Bluetooth, Wi-Fi, WiMax, Cell phone).
Unit 2. ATM: The WAN Protocol 10 Hrs.
Introducing ATM Technology, Introducing Faces of ATM, Explaining the basic concepts of ATM Networking, Exploring the B-ISDN reference model, explaining the Physical Layer, Explaining the ATM Layer, Explaining the ATM Adaptation Layer, Exploring ATM Physical interface, choosing an Appropriate ATM Public Service.

Unit 3. Common Protocols and Interfaces in Upper Layer 6 Hrs.
TCP/IP suite, Network Layer, Transport Layer, Applications Layer.

Unit 4. Routing in the Internet 10 Hrs.

Unit 5. Network Management and Services 8 Hrs.
SNMP: Concept, Management components, SMI, MIB, SNMP format, Messages.

Unit 6. Traffic Engineering and Capacity Planning 8 Hrs.

Reference Books
2. Advance Computer Network- Dayanand Ambawade, Dr. Deven shah, Prof. Mahendra Mehra- Wiley India
3. CCNA Intro – Study Guide – Todd Lammle, Sybex
5. TCP/IP Volume 1, 2, 3, (W. Richard Stevens), Addison Wesley
7. High Performance Communication Networks, (J. Walrand, P. Varaiya), Morgan Kaufmann.
9. High-Speed Networks and Internets, Performance and Quality of Service, - William Stallings, PearsonEducation
First Year M.Tech.
CSL518– Design of Database Systems

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Course Objectives
1. To learn the modeling and design of databases.
2. To acquire knowledge on parallel and distributed databases and its applications
3. To study the usage and applications of Object Oriented database
4. To understand the principles of intelligent databases.
5. To understand the usage of advanced data models

Course Outcomes
At the end of the course students will be able to
1. Model and design databases.
2. Understand parallel and distributed databases.
3. Use Object Oriented databases.
4. Use advanced data models.
5. Understand intelligent databases.

Course Contents

Unit 1. Introduction to Database Design 7 Hrs.
Overview of the design process, the Unified Modeling Language (UML), features of good relational designs, database-design process, database design methodology: conceptual, logical & physical database design. Case study: relational database design of enterprise system.

Unit 2. Object Database System 8 Hrs.
Motivation, structured data types, operations on structured data, encapsulation and ADTs, inheritance, objects OIDs and reference types, database design for ORDBMS, ORDBMS implementation challenges, OODBMS, comparisons of RDBMS, OODBMS and ORDBMS. Case study: Object database design using Oracle / IBM DB2
Unit 3. **Parallel And Distributed Databases**


Unit 4. **Emerging Technologies**


Unit 5. **Security and Authorization**

Introduction to database security, access control, discretionary access control, mandatory access control, security for internet applications, additional issues related to security. Case study : Security and authorization in Oracle / IBM DB2

Unit 6. **Business Intelligence and Data Warehouses**

The Need for Data Analysis, Business Intelligence, Business Intelligence Architecture, Decision Support Data, Online Analytical Processing, Star Schemas, Implementing a Warehouse, Data Mining, SQL Extension for OLAP.

**Text Books**

5. Database Management System – Raghu Ramkrishnan, Johannes Gehrke, Database Management Systems[3e], (MGH)
6. Advanced Database Management System – Rini Chakrabarti-Shilbhadra Dasgupta
7. Data Mining : Introductory and Advanced Topics – Margaret H. Dunham (Pearson Education)
First Year M.Tech.
CSL519: Parallel Algorithms Design

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Course Objectives
1. Understanding of parallel program structure
2. Parallel algorithm design process
3. Parallel Algorithm Performance Issues
4. Shared memory architecture and its issues
5. Study of parallel algorithms.

Course Outcomes
At the end of the course students will be able to
1. Design parallel algorithms for different problems
2. Analyse performance of parallel programs
3. Describe shared memory architecture and cache coherence issues
4. Explain parallel algorithms for matrix multiplication, reduction and linear equations
5. Explain parallel algorithms for Sorting and searching.

Course Contents

Unit 1. Parallel Programs
Unit 2. **Programming for Performance**
10 Hrs.

Unit 3. **Shared Memory Multiprocessors**
10 Hrs.

Unit 4. **Processor Array, Multiprocessor and Multicomputer:**
8 Hrs.
Processor organization, processor array, Multiprocessor, Multicomputer, Flynn’s taxonomy, speedup, scaled speedup and parallelizability, mapping data to processors on processor array and multicomputer.

Unit 5. **Parallel Algorithms-Reduction, Matrix Multiplication and Linear Systems**
9 Hrs.
Reduction, Matrix Multiplication -Sequential matrix multiplication, algorithm for multiprocessor, processor array algorithm, multi-row-column oriented multiplication, block-oriented algorithm. Linear System Algorithms -Back substituting odd even reduction, Gaussian elimination, the Jacobi algorithm, Gauss-Seidel algorithm, Jacobi over relaxation & successive over relaxation, multi grid method, conjugate gradient method.

Unit 6. **Parallel Algorithms - Sorting and searching**
9 Hrs.

**Reference Books**


First Year M.Tech.
CSL520–Advanced Operating Systems

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Course Objectives
1. To gain knowledge on Distributed operating system concepts that includes architecture.
2. To understand Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.
3. To gain insight on to the distributed resource management.
4. To know the components and management aspects of Real time, Mobile operating systems.

Course Outcomes
At the end of the course students will be able to
1. The students should be able to: Discuss the various synchronization, scheduling and memory management issues.
2. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
3. Discuss the various resource management techniques for distributed systems Identify the different features of real time and mobile operating systems.
4. Use available open source kernel Modify existing open source kernels in terms of functionality or features used.

Course Contents
Unit 1. Fundamentals Of Operating Systems    8 Hrs.
Overview – Synchronization Mechanisms – Processes and Threads
Unit 2. **Distributed Operating Systems**  

8 Hrs.

Unit 3. **Distributed Resource Management**  

8 Hrs.

Unit 4. **Real Time And Mobile Operating Systems**  

8 Hrs.

Unit 5. **Case Studies Linux System**  

6 Hrs.

Unit 6. **Study Of Some Commercial Operating Systems**  
QNX : Real Time Operating System, VX Works , Features and applications  

4 Hrs.

**Reference Books**

Course Objectives
1. To understand concept of distributed systems and different architectures.
2. To understand concept and need of fault tolerant systems in distributed environment.
3. To establish local cloud environment in the campus.
4. To understand concept of virtualization in cloud computing.

Course Outcomes
At the end of the course students will be able to
1. Demonstrate need of distributed systems.
2. Build local cloud environment for uploading different parameters.
3. Apply concept of virtualization for real world problems.
4. Work on data security issues in cloud environment.

Course Contents
Unit 1. Introduction

Unit 2. Processes and Communication
Remote Procedure Call, Message Oriented Transient Communication, Physical Clock Synchronization, Logical Clock, Mutual exclusion, Election Algorithms 7 Hrs.

Unit 3. Distributed File Systems and Fault Tolerance
Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Introduction to fault tolerance, Process Resilience, Distributed Commit, Recovery 8 Hrs.
### Unit 4.
**Introduction to Cloud**
04 Getting to know the Cloud, Cloud and other similar configurations, Components of Cloud Computing, Cloud Types and Models: Private Cloud, Community Cloud, Public Cloud, Hybrid Clouds.  
6 Hrs.

### Unit 5.
**Virtualization:**
Introduction and benefits, Implementation Levels of Virtualization, Virtualization at the OS Level, Virtualization Structure, Virtualization Mechanism, Open Source Virtualization Technology, Xen Virtualization Architecture, Binary Translation with Full Virtualization, Para virtualization, Virtualization of CPU, Memory and I/O Devices.  
7 Hrs.

### Unit 6.
**Cloud Computing Services and Data Security in Cloud**
08 Infrastructure as a Service, Platform as a Service, Software as a Service, Database as a Service, Specialized Cloud Services, Challenges with Cloud Data, Challenges with Data Security, Data Confidentiality and Encryption, Data availability, Data Integrity, Cloud Storage Gateways  
7 Hrs.

### Reference Books
1. Distributed Systems: Principles and Paradigms- Tanenbaum, Steen  
Course Objectives
1. To understand basic concepts in embedded systems.
2. To understand software engineering process for design of embedded systems.
3. To learn basic robot operations.
4. To program robots for simple operations.
5. To understand applications of robotics in industries.

Course Outcomes
At the end of the course students will be able to
1. Design simple embedded systems.
2. Differentiate embedded system and microcontroller based systems.
3. Program robots.
4. Demonstrate simple applications using robotics platforms.

Course Contents
Unit 1. Introduction to Embedded systems 3 Hrs.
Embedded Systems, Embedded hardware units and devices in systems, embedded software, design process, types of embedded system.

Unit 2. 8051 Architecture, real world interfacing, advanced architectures 7 Hrs.
,processor and memory organizations, instruction level parallelism, performance metrics, memory types, memory map and addresses, processor selection, memory selection

Unit 3. Device drivers and interrupt services mechanism 6 Hrs.
Programmed I/O, Busy –wait approach, ISR concept, Interrupt services, Multiple interrupts, context and periods for context switching, Interrupt latency and deadline, MA, Device driver programming
Unit 4. **Microcontroller families for Embedded systems**
PIC microcontroller, intel microcontroller, Texas Instruments Microcontrollers, Atmel AVR, ARM. Architecture of Atmel AVR microcontroller, Instructions, addressing and programming in assembly language. Serial, parallel input output programming Mixed C and Assembly language programming, interfacing low voltage and high voltage circuits, Timers, counters programming, using interrupts for i/o operations

Unit 5. **Designing Embedded Systems**
Architecture of Embedded system, hardware/software tradeoff and design, programming embedded systems, process of embedded system development, hardware platforms, communication interfaces.

Unit 6. **Robotics**
Introduction to Fire Bird robot platform, Programming fire bird platform in handle C., Implementing mail merge algorithm on firebird platform, Interfacing HD camera to firebird. six axis and eight axis robot platforms, pick and place robots. Wireless interface for robots, controlling robots using tablets.

Reference Books
2. [www.eyantr.org](http://www.eyantr.org), www.iitbombayx.in (moocs server) for unit 6
First Year M.Tech.
CSL523 –Visual Cryptography

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Course Objectives
1. To understand fundamentals of Visual Cryptography.
2. To distinguish between traditional and extended Visual Cryptography.
3. To summarize different Visual Cryptography schemes.

Course Outcomes
At the end of the course students will be able to
3. Distinguish between traditional and extended Visual Cryptography.
4. Summarize different Visual Cryptography schemes.
5. Apply Visual Cryptography schemes for watermarking.

Course Contents
Unit 1. Traditional Visual Cryptography 8 Hrs.

Unit 2. Extended Visual Cryptography 7 Hrs.

Unit 3. Dynamic Visual Cryptography 6 Hrs.
Introduction, Basic multiple secret sharing, Embedding a share of Visual Cryptography in a Halftone image.
Unit 4. **Color Visual Cryptography**

Unit 5. **Progressive Visual Cryptography**

Unit 6. **Applications of Visual Cryptography**

**Reference Books**
2. Feng Liu, Wei Qi Yan, "Visual Cryptography for Image Processing and Security-Theory, Methods, and Applications", Springer
First Year M.Tech.
CSL524 –Soft Computing

Teaching Scheme

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Evaluation Scheme

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Course Objectives

1. To familiarize with soft computing concepts.
2. To introduce the ideas of Neural networks and fuzzy logic.
3. To understand the concepts of Genetic algorithm and its applications.

Course Outcomes

At the end of the course students will be able to
1. Understand fundamentals of Artificial Neural Networks.
2. Compare different Associative Memory Networks.
3. Perform fuzzy arithmetic.
5. Evaluate hybrid soft computing techniques.

Course Contents

Unit 1. **Artificial Neural Networks – Introduction**


6 Hrs.

Unit 2. **Associative Memory Networks**


9 Hrs.
Unit 3. **Fuzzy Set Theory**  

Unit 4. **Fuzzy Arithmetic and Fuzzy Measures**  

Unit 5. **Genetic Algorithm**  

Unit 6. **Hybrid Soft Computing**  

**Reference Books**
First Year M.Tech.
CSL525 – Biometrics

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<td>1. To understand fundamentals of biometrics.</td>
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<td>2. To gain a broader knowledge and understand the different Biometric techniques.</td>
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<td>3. To learn about biometrics for network security.</td>
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<td>At the end of the course students will be able to</td>
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<tr>
<td>1. Understand fundamentals of biometrics.</td>
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<td>2. Grasp the benefits of Biometric security.</td>
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<td>3. Do Verification and identification.</td>
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<td>4. Compare different technologies of biometric systems.</td>
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<td>5. Apply biometrics for network security.</td>
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<td>Unit 1. Biometric Fundamentals 9 Hrs.</td>
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<td>Introduction, Benefits of biometric security, Verification and identification, Basic working of biometric matching, Accuracy, False match rate, False nonmatch rate, Failure to enroll rate, Derived metrics, Layered biometric solutions.</td>
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| Unit 2. Finger scan 7 Hrs. |
| Features, Components, Operation (Steps), Competing finger Scan technologies, Strength and weakness, Types of algorithms used for interpretation. |

| Unit 3. Facial Scan 6 Hrs. |
| Features, Components, Operation (Steps), Competing facial Scan technologies, Strength and weakness. |
Unit 4.  **Iris Scan**  
Features, Components, Operation (Steps), Competing iris Scan technologies, Strength and weakness.  
6 Hrs.

Unit 5.  **Voice Scan**  
Features, Components, Operation (Steps), Competing voice Scan (facial) technologies, Strength and weakness.  
6 Hrs.

Unit 6.  **Biometrics for Network Security**  
8 Hrs.

**Reference Books**

First Year M.Tech.
CSP526– Design of Database Systems- Lab

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**List of Experiments**

It should consist of minimum 10-12 assignments, based on the syllabus and below mentioned experiment list.

1. To develop and write SQL queries for a distributed database of Bookstore at four sites S1, S2, S3 and S4. The Bookstores are divided into four sites by their ZIP codes.
2. Deadlock Detection Algorithm For Distributed Database Using Wait For Graph.
3. Implement Partitioning on the tables.
4. Implement semi join in distributed DBMS.
5. Implement bloom join in Distributed DBMS
6. Implement two phase commit in distributed DBMS.
7. Develop an application using multivalued Attributes, complex types, procedure, function and Inheritance in ORDBMS
8. Demonstration of Active Database.
10. Implementation of XML commands.
12. Implement K-Means Data Mining Clustering Algorithm.
13. Implement a priori algorithm.
15. Implementation of cube operator in OLAP queries in data warehousing and decision support system.
16. Implement view modification and materialization in data warehousing and decision support systems.
First Year M.Tech.
CSP527–Parallel Algorithms Design- Lab

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List of Experiments

1. Study of different parallel architectures.
2. Write a parallel program to calculate value of PI for different architectures.
3. Write a parallel program to calculate prefix sum for different architectures.
4. Write a parallel program to perform matrix multiplication for SIMD architecture.
5. Write a parallel program to solve linear equations for MIMD architecture.
6. Write a parallel program to find root of non-linear equation.
7. Write a parallel program to solve partial differential equation.
First Year M.Tech.
CSP528–Advanced Operating Systems Lab

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List of Experiments

1. Design and Develop a shell that should support at least 10 commands.
2. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
3. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
4. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF, For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
7. Developing Application using Inter Process Communication (using shared memory, pipes or message queues)
8. Implement the Producer – Consumer problem using semaphores (using UNIX system calls).
9. Implement some memory management schemes
10. Implement any file allocation technique (Linked, Indexed or Contiguous)
First Year M.Tech.
CSP529–Advanced Distributed Systems Lab

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### List of Experiments

1. Installation and configuration of Hadoop/Euceliptus
2. Perform Service deployment and Usage over cloud.
3. Management of cloud resources.
4. Using existing cloud characteristics & Service models.
6. Performance evaluation of services over cloud.
7. Design a distributed application using RMI. Where client submits two strings to the server and server returns the concatenation of the given strings.
8. Design a distributed application which consist of a statefull server using socket primitives.
9. Design a distributed application which consist of a stateless server using socket primitives
10. Design a distributed application which consist of a server and client using threads
First Year M.Tech.
CSP530-Embedded Systems and Robotics Lab

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List of Experiments

1. Study of ARM evaluation system
2. LED interfacing and programming
3. Seven segment interfacing and programming
4. Touch screen sensing
5. LCD interfacing and programming
6. Delay generation using timers
7. Stepper motor interfacing and programming
8. DC motor interfacing and programming
9. Key pad sensing
10. Appliance interfacing through relay
### First Year M. Tech.
**CSS531: Seminar-II**

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Each student is required to do a seminar presentation on a topic preferably from the area chosen for Seminar-I and in which a student intends to work for his dissertation during Semester – III and Semester – IV. Preparation and presentation of a seminar is intended to investigate an in-depth review of literature, prepare a critical review and develop confidence to present the material by the student. The seminar shall be evaluated by a Department Committee constituted for this purpose, based on a report submitted by the candidate and a viva-voce conducted at the end of the semester.
### Second Year PG Program in Computer Science and Engineering
Semester-I

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**Group Details**

A: Basic Science  
B: Engineering Science  
C: Humanities Social Science & Management  
D: Professional Courses & Professional Elective  
E: Free Elective  
F: Seminar/Training/ Project
The objective of this programme is to help the students to identify a specific topic for dissertation in the respective area. This consists of at least two seminar presentations and a first level thesis draft. The first level thesis draft shall be submitted towards the end of the 3rd semester and shall contain problem definition, a brief overview of literature, preliminary algorithms and their implementations, and elementary results on the investigations. The evaluation procedure shall be based on report and presentations.
Second Year M. Tech.
CSP602: Professional Management

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**Course Objectives**

1. To make the students learn basics of Marketing Management
2. To make the students learn basics of Financial Management
3. To make the students learn basics of Human Resource Management
4. To make the students learn professional ethics and Business Etiquettes

**Course Outcomes**

At the end of the course students will be able to

1. Understand basics of Marketing Management.
2. Understand basics of Financial Management
3. Understand basics of Human Resource Management
4. Understand and use professional ethics and Business Etiquettes

**Unit 1**  
**Human Resource Management:**


7Hrs
Unit 2  Marketing Management


Unit 3  Financial Management


Unit 4  Professional Ethics and Business Etiquettes

Professional Ethics: Meaning of ethics, Purposes of engineering ethics, Professional code of conduct, Professional roles to be played by an engineer, Environmental ethics, Computer ethics, Case studies, NSPE Engineer’s creed, Engineers as managers – consulting engineer, Engineers as expert witnesses and advisors.

Business Etiquette: Developing a culture of excellence, principles of exceptional work behaviour, Role of Managers in Business Development. Guidelines for planning a meeting and conducting meeting. Guidelines for attending the meeting for the chairperson, for attendees and for presenters.

Reference Books

3. Financial Management - Khan and Jain
4. Financial Management - Prasanna Chanra
7. Professional Ethics and Human Values by A. Alavudeen, R. Kalil Rehman, M. Jaykumaran, University Science Press, Laxmi Publications Pvt. Ltd. Delhi
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**Group Details**

A: Basic Science

B: Engineering Science

C: Humanities Social Science & Management

D: Professional Courses & Professional Elective

E: Free Elective   F: Seminar/Training/ Project
The final dissertation work shall be based on the work done in part I (CSD601). At least two technical papers are to be prepared for possible publication in Journals of good standard. The evaluation procedure shall be based on report and presentations. There shall be an internal evaluation for the final dissertation done by the M. Tech. committee and an external evaluation by a board consisting of an External examiner, Head of the Department and the Internal Guide.