

|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Core   |                     |
| <b>Prerequisite</b>     | 03070301 – Data and File Structure   |                     |
| <b>Course Objective</b> | 1. Data Structures: To gain proficiency in using and implementing fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.<br>2. Algorithm Design Paradigms: To master different algorithmic techniques<br>3. Algorithm Design: To understand the principles of designing efficient algorithms for various computational problems. |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | Lab | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | -        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
| 1              | <b>Basics of Algorithms and Mathematics</b><br>What is an algorithm? Mathematics for Algorithmic, Sets, Functions and Relations, Vectors and Matrices, Linear Inequalities and Linear Equations. <b>Analysis of Algorithm</b> The efficiency of algorithm, average and worst case analysis, elementary operation, Asymptotic Notation, Analyzing control statement, Analyzing Algorithm using Barometer, Amortized analysis, solving recurrence Equation, Sorting Algorithm, Binary Tree Search   | 10                                 | 15         |
| 2              | <b>Greedy and Dynamic Programming Algorithmic Strategies</b><br><b>Greedy strategy:</b> Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms-Job scheduling and activity selection problem, Making change problem; Graphs: Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm); Graphs: Shortest paths; The Knapsack Problem. <b>Dynamic Programming:</b> Principle, control abstraction, time analysis of control abstraction, binomial coefficient, 0/1 knapsack, Matrix Chain Multiplication, Longest Common Subsequence | 15                                 | 25         |
| 3              | <b>Graph Algorithms</b><br>Breadth First Search (BFS), Depth First Search (DFS), Topological Sort Strongly Connected Components, Euler Tour Generic Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm, Single Source Shortest Path, Dijkstra's Algorithm, Bellman-Ford Algorithm   | 15                                 | 20         |
| 4              | <b>Advanced Algorithms and Applications</b><br>Problem solving, Probabilistic analysis and randomized algorithms, Perfect Hashing, The Floyd - warshall algorithm, Johnson's algorithm for sparse graphs, NP-hard problems, Approximation algorithms, Online algorithms and competitive analysis. Linear- Programming Algorithms: Structure of Optima, Interior Point. Computational geometry: convex hull. Random Walks and Markov chains  | 10                                 | 20         |
| 5              | <b>Algorithmic Case-studies</b><br>Internet of Things and Data Science Algorithms: Algorithms in IoT: Cryptography Algorithms, Scheduling Algorithms, Data management Algorithms and clustering, context management. Data Science Project Life Cycle(DSPLC), Mathematical Considerations: Mathematical modeling, Optimization Methods, Adaptive and Dynamic Algorithms and Numerical Analysis in IoT  | 10                                 | 20         |
| <b>Total</b>   |   | <b>60</b>                          | <b>100</b> |

**Suggested Distribution Of Theory Marks Using Bloom's Taxonomy**

  
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| Level     | Remembrance | Understanding | Application | Analyze | Evaluate | Create |
|-----------|-------------|---------------|-------------|---------|----------|--------|
| Weightage | 30          | 20            | 10          | 10      | 10       | 20     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may

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*vary slightly from above table.*

A handwritten signature in black ink, appearing to read 'Sarbajit'.

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### Course Outcomes

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

|     |   |
|-----|---|
| CO1 | Understanding of fundamental algorithms and data structures.          |
| CO2 | Development of strong problem-solving skills.                         |
| CO3 | Cultivation of algorithmic thinking                                   |
| CO4 | Proficiency in implementing and programming algorithms.               |
| CO5 | Ability to analyze and evaluate algorithm efficiency and correctness. |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Introduction to Algorithms (TextBook)</b><br>By Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein   MIT Press |
| 2. | <b>Algorithms</b><br>By Robert Sedgewick & Kevin Wayne   Pearson Education   |
| 3. | <b>The Algorithm Design Manual (TextBook)</b><br>By Steve S. Skiena   Springer   |

### List of Practical

|    |   |
|----|---|
| 1. | Convert a recursive program to an iterative program.  |
| 2. | Write programs for various paradigms such as Divide and Conquer, Dynamic Programming and Greedy Method. |
| 3. | Write a program to B Tree algorithms  |
| 4. | Write a Code various sorting algorithms   |
| 5. | Work on graph with both representations: adjacency matrix and list                                      |
| 6. | Write code for various graph algorithms   |
| 7. | Write code for geometric algorithms   |



|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Core   |                     |
| <b>Prerequisite</b>     | 03000301- MATHEMATICS-III  |                     |
| <b>Course Objective</b> | 1.Understanding Fundamental Concepts of Information Theory<br>2.Exploring Data Compression Techniques<br>3.Learning Error Detection and Correction<br>4.Analyzing Communication System |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Examination Scheme |     |     |             |
|---------------------------------|----------|-----|--------|--------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks       |     | Lab | Total Marks |
|                                 |          |     |        | SEE                | CIA |     |             |
| 3                               | 1        | -   | 4      | 70                 | 30  | -   | 100         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
| 1              | <b>Probability Theory</b> <ul style="list-style-type: none"> <li>Random Variable and Processes: Review of probability concept, Concept of random variable, Function of random variable.</li> <li>Distribution and density function Moments, characteristic function and conditional statistics, sequence of random variables.</li> <li>Rayleigh, Rice, Lognormal, Poisson distributions, Central limit theorem</li> </ul>   | 12                                 | 20         |
| 2              | <b>Stochastic Processes</b> <ul style="list-style-type: none"> <li>Spectral representation and Random processes, classification and application of stochastic process.</li> <li>Autocorrelation and Cross-correlation function, spectral representation and estimation.</li> </ul>  | 8                                  | 15         |
| 3              | <b>Information theory</b> <ul style="list-style-type: none"> <li>Discrete messages, the concept of information, uniquely decodable code and instantaneously decodable code.</li> <li>Kraft's in-equality and Sardina's Patterson theorem. Average information, Entropy, Information rate.</li> <li>Coding to increase the average information per bit, Probability based Source coding techniques and application.</li> <li>Huffman coding, Shanon-fano code.</li> <li>Arithmetic coding, Marcov chain, Shannon's theorem and channel capacity, Bandwidth and S/N trade off.</li> </ul> | 18                                 | 30         |
| 4              | <b>Channel coding</b> <ul style="list-style-type: none"> <li>Coding for error detection and correction, Hamming distance, Rectangular coding, Block coding and decoding, Cyclic codes, coding and decoding.</li> <li>Convolution codes, Burst error correction codes.</li> </ul>  | 12                                 | 20         |
| 5              | <b>Application of coding</b> <ul style="list-style-type: none"> <li>Multimedia System, Storage and Transmission of text, audio and video.</li> <li>Cryptography and information security.</li> </ul>  | 10                                 | 15         |
| <b>Total</b>   |   | <b>60</b>                          | <b>100</b> |

### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level | Remembrance | Understanding | Analyze | Evaluate | Create |
|-------|-------------|---------------|---------|----------|--------|
|-------|-------------|---------------|---------|----------|--------|

  
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|           |    |    |    |    |    |
|-----------|----|----|----|----|----|
| Weightage | 40 | 20 | 10 | 10 | 20 |
|-----------|----|----|----|----|----|

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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## Course Outcomes

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

|     |   |
|-----|---|
| CO1 | Understand information theory concepts and coding techniques.                     |
| CO2 | Develop skills in designing and implementing error-correcting codes.              |
| CO3 | Enhance analytical abilities for evaluating coding scheme performance.            |
| CO4 | Apply coding techniques to improve data reliability in communication systems.     |
| CO5 | Explore research opportunities and contribute to innovation in coding technology. |

## Reference Books

|    |  |
|----|--|
| 1. | <b>Probability, Random Variable and Stochastic Processes (TextBook)</b><br>By A. Papoulis   Tata McGraw Hill |
| 2. | <b>Introduction to data compression</b><br>By Khalid Sayood   Morgan Kaufmann Publisher                      |
| 3. | <b>Digital Communication</b><br>By John G. Proakis   Tata McGraw Hill  |
| 4. | <b>Modern Digital and Analog communication system (TextBook)</b><br>By B.P.Lathi   Oxford university press   |
| 5. | <b>Error Control Coding (TextBook)</b><br>By Shu Lin D Costello   PHI  |

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|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Core  |                     |
| <b>Prerequisite</b>     | 1. Basic Programming Knowledge<br>2. Fundamental Computer Science Concepts<br>3. Understanding of Formal Languages and Automata<br>4. Basic Understanding of Computer Architecture  |                     |
| <b>Course Objective</b> | 1. Understand System Software for Translation<br>2. Learn Compiler Phases and Design<br>3. Develop Lexical and Syntax Analysis Skills<br>4. Master Syntax-Directed Translation and Memory Management<br>5. Explore Intermediate Code Generation and Optimization<br>6. Understand Code Generation and Symbol Table Management |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | Lab | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | -        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W – Weightage |    |
|----------------|--|------------------------------------|----|
| Sr.            | Topics   | T                                  | W  |
| 1              | <b>Language Translation Overview</b> <ul style="list-style-type: none"> <li>Overview of system software used during translation.</li> <li>Language processors, linker, loader, Types of language processors – assembler, interpreter, compiler. Difference between interpreter, assembler and compiler.</li> <li>Overview and use of linker and loader, Static linking, dynamic linking, Types of Loader, model of compilation,</li> <li>The Phases of a Compiler, Grouping of Phases, Compiler-Construction Tools, Compiler Design Issues</li> </ul>  | 10                                 | 15 |
| 2              | <b>Lexical Analysis and Syntax Analysis</b> <ul style="list-style-type: none"> <li>The Role of the Lexical Analyser, regular expression, regular languages, Input Buffering, Specification of Lexemes, Tokens and pattern.</li> <li>Recognition of Tokens, A Language for Specifying Lexical Analysers, Finite Automata, From a Regular Expression to an NFA, Design of a Lexical Analyser Generator, Optimization of DFA-Based Pattern Matchers.</li> <li>The Role of the Parser, Context-Free Grammars, Writing a Grammar.</li> <li>Top-Down Parsing, Bottom-Up Parsing, Operator-Precedence Parsing, LR Parsers, Using Ambiguous Grammars, Parser Generators.</li> </ul>  | 15                                 | 25 |
| 3              | <b>Syntax-Directed Translation, Memory Allocation , Organization And Memory Management</b> <ul style="list-style-type: none"> <li>Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L-Attributed Definitions, Top Down Translation, Bottom-Up Evaluation of Inherited Attributes, Recursive Evaluators, Analysis of Syntax-Directed Definitions.</li> <li>Type Systems, Specification of a Simple Type Checker, Equivalence of Type Expressions, Type Conversions, Overloading of Functions and Operators.</li> <li>Source Language Issues, Storage Organization, Storage Allocation Strategies, and Access to Non local Names, Parameter Passing, and Language Facilities for Dynamic Storage Allocation, Dynamic Storage Allocation Techniques.</li> <li>Activation Tree, Activation Record, Parameter Passing, Symbol Table, Static, Dynamic And Heap Storage Allocation, Garbage Collection.</li> </ul> | 15                                 | 20 |





4 Intermediate Code Generation, Code Optimization

|    |    |
|----|----|
| 10 | 20 |
|----|----|

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|---|---|----|----|
|   | <ul style="list-style-type: none"><li>• Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls, Types of Intermediate Forms of the Program.</li><li>• The Principal Sources of Optimization, Optimization of Basic Blocks, Loops in Flow Graphs.</li><li>• Introduction to Global Data-Flow Analysis, Iterative Solution of Data-Flow Equations, Linear optimization (peep hole) Techniques, parse optimization Techniques and structured optimization techniques.</li><li>• Code-Improving Transformations, Dealing with Aliases, Data-Flow Analysis of Structured Flow Graphs, Efficient Data-Flow Algorithms, A Tool for Data-Flow Analysis, Estimation of Types, Symbolic Debugging of Optimized Code.</li></ul> |    |    |
| 5 | <b>Code Generation and Symbol Table Management</b>  | 10 | 20 |

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| Course Content |  | T - Teaching Hours   W - Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
|                | <ul style="list-style-type: none"> <li>Issues in the Design of a Code Generator, The Target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, A Simple Code Generator, Register Allocation and Assignment.</li> <li>The DAG Representation of Basic Blocks, Peephole Optimization, Generating Code from DAGs, Dynamic Programming Code-Generation Algorithm, Code-Generator Generators.</li> <li>General concepts of STM, Symbol Table as a data structure, Various operations performed on Symbol Table, Symbol table organizations for blocked structured language and non-blocked structured language.</li> </ul> |                                    |            |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |

| Suggested Distribution Of Theory Marks Using Bloom's Taxonomy |             |               |             |         |          |        |
|---|-------------|---------------|-------------|---------|----------|--------|
| Level   | Remembrance | Understanding | Application | Analyze | Evaluate | Create |
| <b>Weightage</b>  | 30          | 10            | 10          | 30      | 10       | 10     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

| Course Outcomes   |   |
|---|---|
| <b>At the end of this course, students will be able to:</b> |   |
| CO1   | Understand the basic concepts and application of Compiler Design.   |
| CO2   | Understand backend of compiler: intermediate code, Code optimization Techniques and Error Recovery mechanisms           |
| CO3   | Apply basic knowledge Data Structure to design Symbol Table, Lexical Analyzer, Intermediate Code Generation and Parser. |
| CO4   | Understand strength of Grammar and Programming Language   |

| Reference Books |  |
|-----------------|--|
| 1.              | <b>Advanced compiler Design</b><br>By Steven S. Muchnick   Morgan Kaufmann   |
| 2.              | <b>Compiler Design (TextBook)</b><br>By A. A. Puntambekar   Technical Publications   |
| 3.              | <b>Principles of Compiler Design (TextBook)</b><br>By V. Raghavan   McGrawHill   |
| 4.              | <b>Compilers Principles, Techniques and Tools (TextBook)</b><br>By Alfred Aho, Ravi Sethi, Jeffrey D Ullman   Pearson Education Asia |

| List of Practical |   |
|-------------------|---|
| 1.                | Write a program to specify the tokens from given string and recognize it as a valid variable name. Once a variable is valid scan variable values and evaluate expression. |
| 2.                | Write a program to implement lexical analyzer.  |
| 3.                | Write a program to check weather expression is valid or invalid.  |
| 4.                | Write a program to find First() set from given grammar.   |
| 5.                | Write a program to find Follow() set from given grammar.  |
| 6.                | Write a program to remove the Left Recursion from a given grammar   |
| 7.                | Write a program to remove left factoring.   |
| 8.                | Write a program to check whether a string belongs to given grammar or not.  |

|                         |   |                     |
|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Core  |                     |
| <b>Prerequisite</b>     | 03070601- Computer Graphics   |                     |
| <b>Course Objective</b> | <ol style="list-style-type: none"> <li>1. Explore different Geometrical</li> <li>2. Transformations.Describe and apply</li> <li>3. Rendering Methods.</li> <li>4. Apply Image based Shading Methods.</li> <li>5. Understand and explore Radiosity and Texture Mapping.</li> <li>6. Summarize various challenges involved in Computer Graphics.</li> </ol> |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | Lab | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |    |
|----------------|---|------------------------------------|----|
| Sr.            | Topics  | T                                  | W  |
| 1              | <b>3D Transformation</b> <ul style="list-style-type: none"> <li>• 3D-Geometrical Transformations</li> <li>• Shearing and reflection</li> <li>• 3D Clipping and Viewing Transformation</li> <li>• Representation of 3-D object in form of polygon mesh</li> <li>• Curve and surfaces</li> <li>• Parallel and perspective projection</li> <li>• Solid Modeling</li> </ul>   | 10                                 | 20 |
| 2              | <b>Illumination Model and Ray tracing</b> <ul style="list-style-type: none"> <li>• Ambient Light, Diffuse Reflection, Atmospheric Attenuation</li> <li>• Visible surface detection concepts, back-face detection</li> <li>• Computer Animation <ul style="list-style-type: none"> <li>◦ Secular Reflection, Single and Multiple Light Sources</li> </ul> </li> <li>• Recursive Ray Tracing Illumination Model</li> <li>• Intersection Computation, Shadows, Bounding Volumes</li> <li>• Backward vs. Forward Ray Tracing</li> </ul> | 15                                 | 25 |
| 3              | <b>Rendering Polygonal Objects</b> <ul style="list-style-type: none"> <li>• Blackface Culling, Clipping Algorithms</li> <li>• Image based Rendering</li> <li>• Rasterization, Hidden Surface Removal</li> </ul> Z-buffer, and Shading Algorithms (e.g., Gourad Shading and Phong Shading)   | 15                                 | 20 |
| 4              | <b>Radiosity and photon Mapping</b>   | 10                                 | 15 |



|   |   |    |    |
|---|---|----|----|
|   | <ul style="list-style-type: none"><li>◦ The Radiosity Matrix, Progressive Refinement</li><li>◦ Form Factors, the Hemi cube and Hemisphere methods, Other Radiosity Topics</li><li>◦ Photons, Photon Tracing, Photon Scattering</li><li>◦ Storing Photons</li><li>• Rendering, Radiance Estimate</li></ul> |    |    |
| 5 | <b>Texture Mapping and Meshes</b>   | 10 | 20 |

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| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
|                | <ul style="list-style-type: none"> <li>◦ Mapping During Modeling, Two-Stage Mapping</li> <li>◦ Reverse Projection</li> <li>◦ Mapping Polygons, Mapping Parametric Patches, Bump Mapping, View-Dependent Mapping, Procedural Texture Mapping</li> </ul> <ul style="list-style-type: none"> <li>• Mesh Definition and Generation</li> <li>• Mesh Simplification, Mesh Compression, Multi resolution Modeling</li> <li>• Morphing ,character animation and facial animation</li> </ul> |                                    |            |
| <b>Total</b>   |   | <b>60</b>                          | <b>100</b> |

| Suggested Distribution Of Theory Marks Using Bloom's Taxonomy |             |               |             |         |        |
|---|-------------|---------------|-------------|---------|--------|
| Level   | Remembrance | Understanding | Application | Analyze | Create |
| <b>Weightage</b>  | 20          | 30            | 10          | 20      | 20     |

*NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.*

| Course Outcomes   |   |
|---|---|
| <b>At the end of this course, students will be able to:</b> |   |
| CO1   | Explore different Geometrical Transformations.              |
| CO2   | Describe and apply Rendering Methods.                       |
| CO3   | Apply Image based Shading Methods.                          |
| CO4   | Understand and explore Radiosity and Texture Mapping.       |
| CO5   | Summarize various challenges involved in Computer Graphics. |

| Reference Books |  |
|-----------------|--|
| 1.              | <b>Computer Graphics (TextBook)</b><br>By Donald D. Hearn & M.Pauline Baker   Pearson Publication              |
| 2.              | <b>Computer Graphics (TextBook)</b><br>By Donald Hearn and M.Pauline Baker   Donald Hearn and M. Pauline Baker |
| 3.              | <b>Computer Graphics C version</b><br>By Donald Hearn and M.Pauline Baker   PHI                                |
| 4.              | <b>Computer Graphics: A Programming Approach</b><br>By Steven Harrington   TMH                                 |

| List of Practical |   |
|-------------------|---|
| 1.                | Write a program to rotate a Circle around any arbitrary point or around the boundary of another circle.     |
| 2.                | Write a menu driven program to rotate, scale and translate a line point, square, triangle about the origin. |
| 3.                | Write a program to perform shearing on a line.  |
| 4.                | Write a program to implement polygon filling.   |
| 5.                | Write a program to implement transformations in three dimensions.   |

|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Elective   |                     |
| <b>Prerequisite</b>     | 03000302- Academic Writing   |                     |
| <b>Course Objective</b> | Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.<br>Apply Literature Review approach on Research problems<br>Demonstrate Research skills by analyzing and understanding Referencing Styles.<br>Apply and Demonstrate paper writing skills. |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assesment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks     |     | Lab | Total Marks |
|                                 |          |     |        | SEE              | CIA |     |             |
| 0                               | 0        | 8   | 4      | -                | -   | 100 | 100         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W - Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
| 1              | <b>How to Start Research</b><br><br>Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.   | 15                                 | 25         |
| 2              | <b>Research problem Formulation</b><br><br>Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations, Research Design   | 15                                 | 25         |
| 3              | <b>Research Publication &amp; Presentation</b><br><br>Effective literature studies approaches, analysis, Plagiarism , Research ethics, Effective technical writing, how to write report, Paper, Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee | 15                                 | 25         |
| 4              | <b>Research Ethics and Morals</b><br><br>Issues related to plagiarism and ethics. Intellectual Property Rights: Copy rights, Patents, Industrial Designs, Trademarks.  | 15                                 | 25         |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |

| Suggested Distribution Of Theory Marks Using Bloom's Taxonomy |               |         |          |        |
|---|---------------|---------|----------|--------|
| Level   | Understanding | Analyze | Evaluate | Create |
| <b>Weightage</b>  | 25            | 25      | 25       | 25     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Course Outcomes**

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

|     |  |
|-----|--|
| CO1 | Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling. |
| CO2 | Have basic knowledge on qualitative research techniques.   |
| CO3 | Apply Literature Review approach on Research problems.   |
| CO4 | Demonstrate Research skills by analyzing and understanding Referencing Styles.   |
| CO5 | Apply and Demonstrate paper writing skills.  |

**Reference Books**

|    |  |
|----|--|
| 1. | <b>Research Methodology, Methods &amp; Techniques (TextBook)</b><br>By C.R. Kothari   Viswa Prakashan, 2nd Edition, 2009 |
| 2. | <b>Research Methodology: An Introduction</b><br>By Wayne Goddard and Stuart Melville   Juta and Company Ltd, 2004        |
| 3. | <b>How to Write a Thesis (TextBook)</b><br>By R. Murray   Tata McGraw Hill, 2nd Edition, 2010                            |



|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Elective   |                     |
| <b>Prerequisite</b>     | 03070301-Data and File Structure   |                     |
| <b>Course Objective</b> | 1.Understanding Fundamental Concepts<br>2.Developing Proficiency in Machine Learning<br>3.Exploring Advanced AI Topics<br>4.Applying AI Techniques to Real-World Problem |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Examination Scheme |     |     |             |
|---------------------------------|----------|-----|--------|--------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks       |     | Lab | Total Marks |
|                                 |          |     |        | SEE                | CIA |     |             |
| 3                               | -        | 2   | 4      | 70                 | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W – Weightage |    |
|----------------|---|------------------------------------|----|
| Sr.            | Topics  | T                                  | W  |
| 1              | <b>Introduction to Artificial Intelligence Overview</b> <ul style="list-style-type: none"> <li>What is AI ?,Importance and early work in AI</li> <li>AI related fields</li> <li>Defining problems as a state space search, Production systems</li> <li>Production Characteristics, Production System Characteristics</li> <li>Issues in the Design Of Search Programs</li> <li>Additional Problems.</li> <li>Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction</li> <li>Means-Ends Analysis</li> </ul>  | 10                                 | 20 |
| 2              | <b>Knowledge Representation</b> <ul style="list-style-type: none"> <li>Knowledge Representation Issues :Representations And Mappings</li> <li>Approaches to Knowledge Representation</li> <li>Using Predicate Logic Representation Simple Facts in Logic</li> <li>Representing Instance and ISA Relationships</li> <li>Computable Functions And Predicates</li> <li>Representing Knowledge Using Rules, Procedural Versus Declarative Knowledge</li> <li>Logic Programming, Forward Versus Backward Reasoning</li> </ul>  | 15                                 | 20 |
| 3              | <b>Search and Control Strategies, Reasoning</b> <ul style="list-style-type: none"> <li>Search and Control Strategies :Uninformed(Blind) and informed search</li> <li>DFS, BFS, Heuristic Search Techniques : Generate-And-Test, Hill Climbing, Best-First Search, A* , AO* , Problem Reduction, Constraint Satisfaction</li> <li>Reasoning: Symbolic Reasoning Under Uncertainty</li> <li>Introduction to Non-monotonic Reasoning</li> <li>Logics for Non-monotonic Reasoning. Statistical Reasoning</li> <li>Probability And Bay's Theorem, Certainty Factors And Rule-Base Systems</li> <li>Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic</li> </ul> | 15                                 | 20 |
| 4              | <b>Game Playing and Expert System</b>   | 10                                 | 20 |



- Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening
- The Blocks World, Components of A Planning System
- Goal Stack Planning, Nonlinear Planning Using Constraint Posting
- Hierarchical Planning, Reactive Systems, Other Planning Techniques
- Expert System: Introduction, Architecture and Types of Expert System

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| Course Content |  | T - Teaching Hours   W – Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
| 5              | <b>Natural Language Processing and Introduction to Prolog</b> <ul style="list-style-type: none"> <li>Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Spell Checking</li> <li>Introduction: Hopfield Network, Learning in e- Network, Application of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI</li> <li>Introduction To Prolog: Syntax and Numeric Function, Basic List Manipulation, Functions in Prolog, Predicates and Conditional, Input, Output and Local Variables</li> </ul> | 10                                 | 20         |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |


| Suggested Distribution Of Theory Marks Using Bloom's Taxonomy |             |               |             |         |        |
|---|-------------|---------------|-------------|---------|--------|
| Level   | Remembrance | Understanding | Application | Analyze | Create |
| <b>Weightage</b>  | 30          | 30            | 10          | 10      | 20     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

| Course Outcomes   |   |
|---|---|
| <b>At the end of this course, students will be able to:</b> |   |
| CO1   | Explain AI techniques, models, criteria, and search techniques      |
| CO2   | Analyse knowledge representation                                    |
| CO3   | Learn Symbolic reasoning and probabilistic reasoning                |
| CO4   | Describe Game playing and planning of different types               |
| CO5   | Understanding natural language processing and connectionist models. |

| Reference Books |   |
|-----------------|---|
| 1.              | <b>Neural Networks, Fuzzy logic and Genetic algorithms (TextBook)</b><br>By S. Rajasekaran, G. A. Vijayalakshmi Pai   PHI publication |
| 2.              | <b>Artificial Intelligence (TextBook)</b><br>By Iain Rich And Kevin Knight   Tata Mcgraw-Hill   |
| 3.              | <b>PROLOG Programming For Artificial Intelligence</b><br>By Ivan Bratko   Pearson Education   |
| 4.              | <b>Artificial Intelligence: A Modern Approach</b><br>By Stuart Russel, Peter Norvig,   PHI  |

| List of Practical |  |
|-------------------|--|
| 1.                | Write a program to implement Tic-Tac-Toe game problem.   |
| 2.                | Write a program to implement BFS (for 8 puzzle problem or Water Jug problem or any AI search problem). |
| 3.                | Write a program to implement BFS (for 8 puzzle problem or Water Jug problem or any AI search problem)  |
| 4.                | Write a program to implement Single Player Game (Using Heuristic Function).                            |
| 5.                | Write a program to Implement A* Algorithm.   |
| 6.                | Write a program to solve N-Queens problem using Prolog.  |
| 7.                | Write a program to solve 8 puzzle problem using Prolog.  |
| 8.                | Write a program to solve travelling salesman problem using Prolog.                                     |

  
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|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Elective   |                     |
| <b>Prerequisite</b>     | 03070401-Operating System  |                     |
| <b>Course Objective</b> | Comprehending Distributed System Fundamentals<br>Understanding Distributed System Architectures<br>Exploring Distributed Algorithms and Protocols<br>Implementing and Managing Distributed Resources |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | Lab | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | -        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
| 1              | <b>Introduction to distributed Systems</b><br>Definition and goals, History, Centralized vs Distributed System, Hardware and Software concepts, Distributed computing models, Strengths and weaknesses of distributed, Design issues.   | 10                                 | 15         |
| 2              | <b>Communication in distributed system</b><br>Computer Network and Layered protocols, Message passing and related issues, IPC, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC RMI basics, RMI Implementation, Java RMI. <b>Synchronization in distributed system</b> Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems. Election algorithms: Bully algorithm, Ring algorithm, Leader election in rings, Anonymous rings, Asynchronous rings, Synchronous rings. | 15                                 | 25         |
| 3              | <b>Processes and processors in distributed systems</b><br>Threads, system model, processor allocation. Scheduling in distributed systems: Load balancing and sharing approach. Fault tolerance, Real time distributed systems, Process migration and related issues.  | 10                                 | 20         |
| 4              | <b>Distributed File Systems</b><br>Introduction, features & goal of distributed file system, file models, file accessing models. File sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, Design Principles, Case study   | 10                                 | 20         |
| 5              | <b>Distributed Shared Memory</b><br>Introduction, general architecture of DSM systems. Design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing.   | 10                                 | 20         |
| <b>Total</b>   |   | <b>55</b>                          | <b>100</b> |

| Suggested Distribution Of Theory Marks Using Bloom's Taxonomy |             |               |             |         |          |        |
|---|-------------|---------------|-------------|---------|----------|--------|
| Level   | Remembrance | Understanding | Application | Analyze | Evaluate | Create |
| <b>Weightage</b>  | 30          | 20            | 20          | 10      | 10       | 10     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

  
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### Course Outcomes

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

|     |   |
|-----|---|
| CO1 | Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement  |
| CO2 | Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constraints. |
| CO3 | Describe different types of faults and fault handling techniques in order to implement fault tolerant systems.  |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Distributed Operating System (TextBook)</b><br>By P.K.Sinha   PHI                         |
| 2. | <b>Distributed Operating System (TextBook)</b><br>By Andrew S. Tanenbaum   Pearson Education |
| 3. | <b>Distributed Computing</b><br>By Sunita Mahajan & Seema Shah   Oxford University Press     |

### List of Practical

|    |   |
|----|---|
| 1. | Implement concurrent echo client-server application.    |
| 2. | Implement PI calculation Service using RPC programming. |
| 3. | Implement Calculator Service using SUN RPC.             |
| 4. | Implementation of "Hello Word" Service using JAVA RMI.  |
| 5. | Implementation of "Calculator" Service using JAVA RMI.  |
| 6. | Mobile agent (IBM's Aglet) Programming.                 |
| 7. | Implement Network File System ( NFS )                   |

|                         |   |                     |
|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 1</b> |
| <b>Type of Course</b>   | Elective  |                     |
| <b>Prerequisite</b>     | 03070602- cryptography and network security   |                     |
| <b>Course Objective</b> | Understanding Cryptographic Principles<br>Implementing and Analysing Cryptographic Technique<br>Exploring Network Security Fundamentals |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | Lab | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | -        | 2   | 3      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W – Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
| 1              | <b>Basic Overview of Cryptography</b><br>Cryptography Attacks, Services and Techniques Symmetric Key ciphers and Asymmetric Cipher DES analysis, Security of DES, Transformation Analysis of AES   | 10                                 | 15         |
| 2              | <b>Conventional Encryption Techniques</b><br>Conventional Encryption Algorithm Comparison between Algorithm(IDEA, DES, Triple DES,RC5, Blowfish) Random Number Generation Public Key Infrastructure Elliptic curve Arithmetic Diffie- hellman Key Exchange   | 15                                 | 20         |
| 3              | <b>Message Authentication and Hash Function</b><br>Authentication and Authorization Authentication via key ownership Hash Function, Security of Hash Function Birthday Attack Generating and Exchanging Keys Non-repudiation using Digital Signature Key management, E-voting  | 15                                 | 25         |
| 4              | <b>Intrusion Detection and Issues</b><br>Intrusion Detection Overview, Host based intrusion detection systems Network based intrusion detection systems, IDS as part of the overall Security System IDS Signatures and Analysis Schemes for Intrusion Detection Systems Anomaly detection, Expert Systems Tools for packet analysis and intrusion detection, Some intrusion detection Tools (Snort, Windup, Ethereal etc.) | 10                                 | 20         |
| 5              | <b>Network security and IP Security</b><br>Digital Signature in the real world Digital Certificate Kerberos, Authentication Protocol IP Security: IP security Architecture, Authentication Header Encapsulating Security Payload, PGP,S/MIME Secure Socket Layer(SSL):Architecture, Protocol Secure Electronic Transaction(SET):Services, Requirement, Features, Participants, Firewall Design Principles                  | 10                                 | 20         |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |

### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level            | Remembrance | Understanding | Application | Analyze | Create |
|------------------|-------------|---------------|-------------|---------|--------|
| <b>Weightage</b> | 20          | 30            | 20          | 10      | 20     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

  
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### Course Outcomes

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

|     |  |
|-----|--|
| CO1 | Understand different security models and attacks   |
| CO2 | Enable the students to learn fundamental concepts of computer security and cryptography and utilize these techniques in computing systems. |
| CO3 | Understand management issues and algorithm   |
| CO4 | Understand different security issues and their types   |
| CO5 | Study and evaluate different encryption techniques of cryptography   |
| CO6 | Configuration of encryption algorithm and check their output   |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Cryptography and Network Security (TextBook)</b><br>By William Stalling   Pearson |
| 2. | <b>Network Security Essentials</b><br>By William Stalling   Pearson                  |

### List of Practical

|     |  |
|-----|--|
| 1.  | Implement the Pure Transposition Cipher  |
| 2.  | Implement DES Encryption and Decryption.   |
| 3.  | Draw diagram of Public Key Infrastructure.   |
| 4.  | Draw diagram of Centralized/Decentralized Infrastructure.  |
| 5.  | Implement the AES Encryption and decryption.   |
| 6.  | Implement RSA Encryption Algorithm.  |
| 7.  | Implementation of Hash Functions.  |
| 8.  | Demonstrate Sniffing using packet tool.  |
| 9.  | Draw diagram Host-based Intrusion Detection System.  |
| 10. | Configure your e-mail account against various threats. i.e. spam attack, phishing, spoofing etc. |

|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Core Courses   |                     |
| <b>Prerequisite</b>     | Students should have knowledge of the following concepts to learn this subject.<br>Operating System, Computer Organization and Architecture, Microprocessor and Architecture, Data structure and algorithms.   |                     |
| <b>Course Objective</b> | <ol style="list-style-type: none"> <li>1. Understand High Performance Computing (HPC) system architectures and various computational models.</li> <li>2. Learn basics of CUDA programming.</li> <li>3. Apply parallel execution models and methodologies for parallel programming and parallel applications development.</li> <li>4. Design and implement compute intensive applications on HPC platform.</li> </ol> |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |    |
|----------------|---|------------------------------------|----|
| Sr.            | Topics  | T                                  | W  |
| 1              | <b>Introduction To Grid Computing</b><br>Overview of GCE Infrastructure of hardware and software Main Projects and Applications, Application Management Language support (MPI- G, MPI-G2, etc) for grid computing Middleware for building grid computing environments The Open Grid Forum, GARUDA, Grid Architecture, Sun grid engine Sky server and national Grid Grid Portals, Grid Standard Security   | 10                                 | 15 |
| 2              | <b>Cluster Computing</b><br>Cluster Architectures ,Classification Parallel Computer Architecture Cluster Interconnects, SSI Boundaries Resource Management and Scheduling(RMS) Message Passing System(MPS) Distributed shared Memory(DSM) Cluster Administration Tools Dependable Clustered Computing: Structure, Dependability Attributes` Share Nothing versus Shared Storage Active/Standby versus Active/Active ,Interconnects , Detecting and Masking Faults Self Testing , Processor, Memory, and Buses Cluster Computer and its Architecture clusters Classification The Practice of Dependable Clustered Computing , Microsoft Cluster Server Meta Computing: Design ,objective and Issues, Meta computing Environments Case Studies of Cluster Systems | 15                                 | 25 |
| 3              | <b>High Speed Networks</b><br>HPC Performance Measurement Performance Measures of Parallel Algorithms: Power-Aware Computing and Communication Power-aware Processing Techniques Introduction, Choice of High Speed Networks, General Architecture HiPPI(High Performance Parallel Interface): HiPPI Connection Management ,HiPPI Interfaces , HiPPI Interconnect High Speed SONET Extensions Asynchronous Transfer Mode (ATM), Issues in Distributed Networks for ATM Networks Scalable Coherent Interface (SCI) : Data Transfer via SCI , Advantages of SCI Network RAM: Issues in Using Network RAM, Remote Memory Paging, Applications of Network RAM in Databases, Transaction-Based System  | 15                                 | 25 |
| 4              | <b>Distributed Shared Memory</b><br>Data Consistency, Data Location, Write Synchronization , Double Faulting , Relaxing Consistency Application/Type-specific Consistency , Network Performance Issues , Other Design Issues, Synchronization , Granularity , Address-Space Structure Replacement Policy and Secondary Storage Heterogeneity Support , Fault Tolerance , Memory Allocation Data Persistence   | 10                                 | 20 |
| 5              | <b>Parallel Methodologies and System</b>  | 10                                 | 20 |





Introduction ,The Parallel I/O Problem, Regular Problems, Irregular Problems Disk-Directed I/O , Two Phase Data Administration, Software RAID and Parallel File systems Physical Placement of Data, Increasing the Visibility of the File systems Log-Structured File systems Network-Attached Devices, Multilevel Caching, Cooperative Caching Transparent Informed Per fetching , Scheduling Parallel Pre fetching and Caching

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|              |           |            |
|--------------|-----------|------------|
| <b>Total</b> | <b>60</b> | <b>105</b> |
|--------------|-----------|------------|

### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level            | Remembrance | Understanding | Application | Analyze | Create |
|------------------|-------------|---------------|-------------|---------|--------|
| <b>Weightage</b> | 35          | 15            | 20          | 10      | 20     |

*NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.*

### Course Outcomes

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

|     |  |
|-----|--|
| CO1 | Gain an understanding of high-performance computing principles and techniques      |
| CO2 | Develop skills in parallel programming and optimization for efficient computation. |
| CO3 | Learn how to utilize advanced computing architectures and technologies.            |
| CO4 | Apply HPC knowledge to solve complex computational problems in various domains.    |

### Reference Books

|    |   |
|----|---|
| 1. | <b>Grid Computing (TextBook)</b><br>By Joshy Joseph, Craig Fellenstein   Prentice Hall, IBM Press                           |
| 2. | <b>High Performance Cluster Computing: Architectures and Systems (TextBook)</b><br>By RajkumarBuyya   Prentice Hall         |
| 3. | <b>Cloud Computing: Principles and Paradigms</b><br>By RajkumrBuyya, James Broberg, Andrzej M Goscinski   Wiley Publication |



## List of Practical

|    |  |
|----|--|
| 1. | Cluster computing Architecture and Cluster Software, Design Decisions        |
| 2. | Distributed File Systems, Benchmarks   |
| 3. | Load Sharing and Load Balancing  |
| 4. | Grid Systems, Application Management, Grid Application Description Languages |
| 5. | Case Studies of Cluster Systems & Grid Computing                             |
| 6. | HPC Performance Measurement  |
| 7. | Performance Measures of Parallel Algorithms                                  |

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|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Core Courses   |                     |
| <b>Prerequisite</b>     | BEC505-Digital Signal Processing   |                     |
| <b>Course Objective</b> | <ol style="list-style-type: none"> <li>1. To study the image fundamentals and mathematical transforms necessary for image processing.</li> <li>2. To study the image enhancement techniques</li> <li>3. To study image restoration procedures.</li> <li>4. To study the image compression procedures.</li> </ol> |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
| 1              | <b>Introduction of Digital Image Processing</b> <ul style="list-style-type: none"> <li>• Introduction, components of Digital Image Processing, examples</li> <li>• Steps in Digital Image Processing</li> <li>• Elements of Visual perception, Light and Electromagnetic spectrum</li> <li>• Image Sensing and application</li> <li>• Image sampling and quantization, Basic relationships between pixels, mathematical tools</li> </ul>                    | 10                                 | 15         |
| 2              | <b>Image Enhancements</b> <ul style="list-style-type: none"> <li>◦ In spatial domain: Basic gray level transformations</li> <li>◦ Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters</li> <li>◦ Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters</li> <li>• Sharpening frequency domain filters</li> </ul>             | 15                                 | 25         |
| 3              | <b>Image Restoration and Color Image Processing</b> <ul style="list-style-type: none"> <li>• Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering</li> <li>• Color Image processing: Color fundamentals, Color models, Color transformation, Smoothing and Sharpening, Color segmentation</li> </ul>                          | 15                                 | 25         |
| 4              | <b>Wavelet and Multi resolution processing and Image Compression</b> <ul style="list-style-type: none"> <li>◦ Image pyramids, Multi-resolution expansion, wavelet transform</li> <li>◦ Image Compression: Introduction, Image compression model</li> <li>• Huffman Coding, Arithmetic coding, Digital Image water marking</li> </ul>  | 8                                  | 15         |
| 5              | <b>Morphological Image processing and Image segmentation:</b> <ul style="list-style-type: none"> <li>• Preliminaries, Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformation, Basic morphological algorithms for boundary extraction, Region filling, extraction of connected components, thinning and thickening.</li> <li>• Image segmentation: Detection of discontinuities, Edge linking and boundary detection, thresholding</li> </ul> | 12                                 | 20         |
| <b>Total</b>   |   | <b>60</b>                          | <b>100</b> |



### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level     | Remembrance | Understanding | Application | Evaluate | Create |
|-----------|-------------|---------------|-------------|----------|--------|
| Weightage | 20          | 20            | 20          | 10       | 30     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books

|    |  |
|----|--|
| 1. | <b>Digital Image Processing (TextBook)</b><br>By Rafael C. Gonzalez and Richard E. Woods   Pearson Education, latest edition |
| 2. | <b>Digital Image Processing (TextBook)</b><br>By Bhabatosh Chanda and Dwijesh Majumde   PHI                                  |
| 3. | <b>Fundamentals of Digital Image Processing</b><br>By Anil K Jain   PHI  |
| 4. | <b>Digital Image Processing Using Matlab</b><br>By Rafael C. Gonzalez and Richard E. Woods   Pearson Education               |

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## List of Practical

|     |  |
|-----|--|
| 1.  | Image Enhancement: Point Processing Techniques, Histogram Equalization.                    |
| 2.  | Image Enhancement: Estimate noise parameter of noisy image and design filter to remove it. |
| 3.  | Image Enhancement: Remove motion blur.   |
| 4.  | Perform Digital Image water marking.   |
| 5.  | Morphological Operations: Gray image Erosion & Dilation.                                   |
| 6.  | Morphological Processing: Boundary Extraction, Object Identification.                      |
| 7.  | Segmentation: Split and Merge Algorithms.  |
| 8.  | Detection of motion by differencing.   |
| 9.  | Image Segmentation: Hough transform for lines and circles.                                 |
| 10. | Feature Extraction: Texture filters.   |

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|                         |   |                     |
|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Core Courses  |                     |
| <b>Prerequisite</b>     | 1. Understand the concepts of Data Ware housing and Data Mining Concepts.<br>2. Explain the methodologies used for analysis of data<br>3. Describe various techniques which enhance the data modeling.<br>4. Discuss and Compare various approaches with other techniques in data mining and data ware housing  |                     |
| <b>Course Objective</b> | 1. Be familiar with mathematical foundations of data mining tools.<br>2. Understand and implement classical models and algorithms in data warehouses and data mining<br>3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.<br>4. Master data mining techniques in various applications like social, scientific and environmental context.<br>5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems. |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |    |
|----------------|---|------------------------------------|----|
| Sr.            | Topics  | T                                  | W  |
| 1              | <b>Introduction to Data Warehouse and OLAP Technology for Data Mining</b> <ul style="list-style-type: none"> <li>What is Data Warehousing, Data Warehousing concepts, Methodology for Data Warehousing, Issues in Data Warehousing, Benefits of Data Warehousing.</li> <li>Data Warehouse and Data Mart, Metadata, Use of metadata in Data Warehouse, Tools for metadata.</li> <li>Multidimensional data Model, Data warehouse Data Model, Data warehouse Architecture, Data warehouse Implementation.</li> <li>Development of Data Cube Technology, OLAP in the Data Warehouse, Demand for OLAP, Major features and Functions (Drill-down, Rollup, Slice, Dice), OLAP Models, OLAP Tools</li> <li>From Data warehousing to Data Mining.</li> </ul>   | 10                                 | 20 |
| 2              | <b>Introduction to Data Mining and Data Pre-processing</b> <ul style="list-style-type: none"> <li>Basics of Data Mining, Importance of Data Mining, Data Mining functionalities, Classification of Data mining systems.</li> <li>Data mining architecture, KDD Process, Major Issues in Data Mining, Applications of Data Mining, Social impacts of data mining.</li> <li>Integration of a Data Mining system with a Database or a Data Warehouse.</li> <li>Data Pre-processing and its need.</li> <li>Data cleaning: Missing Values, Noisy Data, Data Integration and transformation, Data Reduction: Data cube aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction.</li> <li>Data Mining Primitives, Languages and System Architectures: Task relevant data, Kind of Knowledge to be mined, Discretization and Concept Hierarchy, Mining Class Comparison.</li> </ul> | 20                                 | 30 |
| 3              | <b>Association Rule Mining</b>  | 10                                 | 15 |

|              |  |           |            |
|--------------|--|-----------|------------|
|              | <ul style="list-style-type: none"> <li>Basic Concepts, Market Basket Analysis, Mining of Single dimensional Boolean association rules, Multilevel association rules and Multidimensional association rules</li> <li>Correlation Analysis, Constraint based association Mining</li> <li>Finding frequent item sets, Support and Confidence.</li> <li>Apriori algorithm, generating rules, Improved Apriori algorithm, Incremental ARM, Associative Classification, Rule Mining.</li> </ul>  |           |            |
| <b>4</b>     | <b>Classification and Predication</b>  | <b>10</b> | <b>15</b>  |
|              | <ul style="list-style-type: none"> <li>Classification and Prediction, Basic Concepts, Basic issues regarding classification and predication.</li> <li>Classification by Decision Tree, Bayesian classification, classification by back propagation, Associative classification.</li> <li>Classification Based On Concepts From Association Rules Mining, Other Methods, Such As Genetic Algorithm, Fuzzy Set Approach, Case Based Reasoning, Etc.,</li> <li>Prediction, Classifier Accuracy, Linear and nonlinear regression, Logistic Regression</li> </ul>   |           |            |
| <b>5</b>     | <b>Cluster Analysis and Mining complex Types of data</b>   | <b>10</b> | <b>20</b>  |
|              | <ul style="list-style-type: none"> <li>Cluster Analysis: An Overview &amp; Basic Concepts, basic issues, clustering using partitioning methods, Hierarchical methods, Density based methods, Grid based methods and model based methods, Algorithms for outlier analysis.</li> <li>Mining complex Types of data: Multidimensional analysis and descriptive mining of complex data objects, Introduction to spatial mining, multimedia mining, temporal mining, text Mining, Time Series &amp; Sequence Data and web mining with related algorithms.</li> </ul> |           |            |
| <b>Total</b> |  | <b>60</b> | <b>100</b> |

### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level            | Remembrance | Understanding | Application | Analyze | Evaluate | Create |
|------------------|-------------|---------------|-------------|---------|----------|--------|
| <b>Weightage</b> | 10          | 30            | 10          | 20      | 10       | 20     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Course Outcomes

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

|     |   |
|-----|---|
| CO1 | Understand the functionality of the various data mining and data warehousing component      |
| CO2 | Appreciate the strengths and limitations of various data mining and data warehousing models |
| CO3 | Explain the analyzing techniques of various data using OLAP Cube                            |
| CO4 | Describe different methodologies used in data mining and data ware housing.                 |
| CO5 | Compare different approaches of data ware housing and data mining with various technologies |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Data Mining – Concepts &amp; Techniques (TextBook)</b><br>By Jiawei Han Micheline Kamber   Morgan Kaufmann Publishers |
| 2. | <b>Mordern Data Warehousing, Data Mining and Visualization (TextBook)</b><br>By George M. Marakas   Pearson              |
| 3. | <b>Data Mining</b><br>By Vikram Puri P.RadhaKrishana   Oxford Press  |
| 4. | <b>Data Mining</b><br>By Arun K. Pujari   University Press   |





## List of Practical

|     |  |
|-----|--|
| 1.  | Write a Java code to Generate Random 10,000 numbers and store into csv file.   |
| 2.  | Write a Java code to Generate Random 10,000 numbers and store as 100*100 array in csv file and then apply any sorting method on the same data.   |
| 3.  | Write a C++/C#/JAVA program to perform min-max normalization, z-score normalization and decimal scaling operation.   |
| 4.  | Write a Program of Binning Methods for data smoothing.   |
| 5.  | Write a Java code to implement the Apriori Algorithm.  |
| 6.  | Write a Java code Find frequent item set using FP growth method.   |
| 7.  | Write a Java code to implement naive based Algorithm.  |
| 8.  | Write a Java code to implement K-means algorithm.  |
| 9.  | Study WEKA (Data Mining Tool). Install WEKA and shows you how to use the Weka machine learning workbench. Explain how Machine Learning Tools, techniques and data mining algorithms works. |
| 10. | Perform K-Means Algorithm with the help of WEKA.   |

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|                         |   |                     |
|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Core Courses  |                     |
| <b>Prerequisite</b>     | Typical requirements generally include at least three years of experience in a related role, the ability to communicate, formal training, and a PMP certification. Certification can be acquired through a professional association, a university or college, or through a specially focused online learning program. |                     |
| <b>Course Objective</b> | 1. Understand quality management processes.<br>2. Distinguish between the various activities of quality assurance, quality planning and quality control.<br>3. Understand the importance of standards in the quality management process and their impact on the final product   |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 1        | 0   | 4      | 70                | 30  | 0   | 100         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W - Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
| 1              | <b>Introduction to Software Project Management System</b><br>Overview of Project Planning, Project Estimation, Project Scheduling, Organization and Team Structure, Risk Analysis and Management, Resource Allocation  | 12                                 | 15         |
| 2              | <b>Project Tracking and Configuration Management</b><br>Measurement of Physical and Financial progress, Earned value analysis, Status reports and Milestone reports, SCM activities, Standards for Configuration Audit Functions, Personnel in SCM Activities, Change control, Source code Control System (SCCS), Software Configuration Management: Some Pitfalls   | 15                                 | 25         |
| 3              | <b>Project Management Concepts &amp; Project Metrics:</b><br>The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains (FP & LOC), Software Measurement, Metrics for Project and Software Quality, Project Planning Objectives, Software Project Estimation using COCOMO Model, Software Scope and Resources, Empirical Estimation Models, Automated Estimation Tools, Basic Concepts and Relationship Between People and Effort, Defining a Task Set for the Software Project.   | 12                                 | 25         |
| 4              | <b>Risk Analysis &amp; Management: Reactive versus Proactive Risk</b><br>Strategies, Software Risks (Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation), Risks Monitoring and Management  | 10                                 | 15         |
| 5              | <b>Introduction to quality assurance</b><br>Overview of SQA planning, techniques and contents of a SQA plan, establishing quality goals - Quality Function Deployment-Goal/Question/Measure Paradigm, total quality Management, cost of quality, quality assurance management, quality standards, factors affecting SQA effort, Management review process - technical review process -software assertion process - walkthrough process - audit process - verification & validation, Measuring quality, measurement criteria, product and process quality metrics, metrics for configuration management and software maintenance, example of metrics programs, complexity metrics and their relationship with testing and quality, metrics for object-oriented software analysis. | 11                                 | 20         |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |

### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level     | Remembrance | Understanding | Analyze | Evaluate |
|-----------|-------------|---------------|---------|----------|
| Weightage | 40          | 20            | 20      | 20       |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Course Outcomes

| At the end of this course, students will be able to: |   |
|--|---|
| CO1  | Apply project management concepts and techniques to an IT project.          |
| CO2  | Explain project management in terms of the software development process.    |
| CO3  | Apply project management concepts through working in a group as team leader |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Software Project Management in Practice (TextBook)</b><br>By Pankaj Jalote   Pearson, Education Asia      |
| 2. | <b>Software Engineering: A practical Approach</b><br>By Roger S. Pressman   Fifth Edition 2001, McGraw-Hill. |
| 3. | <b>CMM in Practice (TextBook)</b><br>By Pankaj Jalote   Addison-Wesley Longman Publishing Co.                |

### List of Tutorial

|    |  |
|----|--|
| 1. | Design System Requirement Specification (SRS) document for the given project in group of 4-5 team members and define scope and feasibility report of project.  |
| 2. | To study the estimation techniques COCOMO using LOC, Function Point, Feature point metrics. After manual calculation use COSTAR Tool to calculate and explore other parameters for estimation of Cost of your Project. |
| 3. | To prepare SPMP document of given definition.  |
| 4. | Design the following for given project using WhiteBox and BlackBox Approach Test Case Test Suite Testing Strategy Also perform manual unit and integrated testing on the developed project.                            |
| 5. | Study various Testing Tools in groups and present in team. Using any one Testing tools do Automated Testing of your Project (QTP, Win Runner, Load Runner, Silk Test, etc.).   |

|                         |   |                     |
|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Core Courses  |                     |
| <b>Prerequisite</b>     | These may differ from one university to another but here are some general guidelines for prerequisites to learn “numerical analysis”: advanced calculus, (advanced) linear algebra, and differential equations. A course in partial differential equations would be helpful too.  |                     |
| <b>Course Objective</b> | <ol style="list-style-type: none"> <li>1. Obtain an intuitive and working understanding of numerical methods for the basic problems of numerical analysis.</li> <li>2. Gain experience in the implementation of numerical methods using a computer.</li> <li>3. Trace error in these methods and need to analyze and predict it.</li> </ol> |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 1        | 0   | 4      | 70                | 30  | 0   | 100         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
| 1              | <b>Solutions of Non-Linear Equations:</b><br>Absolute, Relative and Percentage Error, Roots of an equation, Linear and non-Linear equations (Definition and Difference), Iterative Methods for finding roots of non-Linear equations : Bisection Method, False Position Method, Newton-Raphson Method and secant Method - Example only- No algorithm.   | 10                                 | 15         |
| 2              | <b>Solution of Simultaneous Linear Equations:</b><br><b>Solution of Simultaneous Linear Equations:</b> Definitions: System of linear equations, Existence of unique roots, multiple roots and no roots, Difference between direct and iterative methods, Gauss-Elimination Method, Gauss-seidel Method.   | 10                                 | 15         |
| 3              | <b>Frequency Distribution</b><br>Collection of data, Classification of data, Class interval, Types of Classes, Class frequency, Class mark, Class Boundaries, Width of a class, Frequency density, Relative frequency, Percentage frequency, Cumulative frequency. Introduction, Arithmetic Mean, Simple and weighted for raw data, Discrete frequency distribution, Continuous frequency distribution, Properties of A.M., Merits & De merits of A.M., Median for raw data, Discrete frequency distribution, Continuous frequency distribution, Merits and demerits of Median, Mode for raw data, D.f.s., c.f.s., Merits & demerits of mode. Introduction, Range, coefficient of range, Quartiles, Quartiles deviations, coefficient of quartile deviations, Mean deviation and coefficient of mean deviation, S.D and variance for all types of frequency distribution, Coefficient of variation. | 20                                 | 30         |
| 4              | <b>Correlation:</b><br>Definition of Correlation, Types of Correlation, Scatter Diagram Method, Karl Person’s Correlation Coefficients, Correlation Coefficients for Bivariate frequency distribution, Probable error for Correlation Coefficients  | 10                                 | 20         |
| 5              | <b>Regression:</b><br>Definition of Regression, Regression lines, Regression Coefficients, Properties of regression Coefficients, Fitting of regression lines and estimation for Bivariate frequency distribution.  | 10                                 | 20         |
| <b>Total</b>   |   | <b>60</b>                          | <b>100</b> |



### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level     | Remembrance | Understanding | Application | Analyze |
|-----------|-------------|---------------|-------------|---------|
| Weightage | 40          | 30            | 20          | 10      |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Course Outcomes

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

|     |   |
|-----|---|
| CO1 | Mastery of numerical methods for solving mathematical problems in a computer-based environment.                 |
| CO2 | Proficiency in numerical techniques such as interpolation, integration, and root finding.                       |
| CO3 | Ability to analyze and evaluate the accuracy and efficiency of different numerical algorithms.                  |
| CO4 | Skill in implementing numerical methods using programming languages and software tools                          |
| CO5 | Knowledge of advanced topics such as numerical optimization and numerical solutions for differential equations. |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Statistical Methods (TextBook)</b><br>By S.P. Gupta   Sultan Chand & Sons |
| 2. | <b>Business Statistics (TextBook)</b><br>By R.S. Bhardwaj   Excel books      |
| 3. | <b>Fundamental of Statistics (TextBook)</b><br>By S.C. Gupta.   Sultan Chand |
| 4. | <b>Introductory Methods of Numerical Analysis</b><br>By S.S. Sastry.   PHI   |
| 5. | <b>Computer Oriented Numerical Methods</b><br>By Rajaraman V.   PHI          |

|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Discipline Specific Elective Courses   |                     |
| <b>Prerequisite</b>     | Knowledge of basic Web technologies such as HTML, CSS, and JavaScript is required.<br>Knowledge of Python is helpful.<br>High motivation and commitment.<br>Good teamwork skills.  |                     |
| <b>Course Objective</b> | To comprehend the basics of the internet and web terminologies. To introduce scripting language concepts for developing client-side applications. To practice server-side programming features – PHP, JSP. To know the usefulness of web services. |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
| 1              | <b>Web Technologies Introduction</b><br>Introduction ,Web Essentials: Clients, Servers, Communication, Basic Internet Protocols, HTTP Request Message, HTTP Response Message, HTTPS protocol, Web Clients, Generations of web applications  | 10                                 | 15         |
| 2              | <b>Introduction to Client-Side Programming</b><br>Introduction to JavaScript, Basic Syntax, Variables and Data Types, Statements, Operators, literals, functions. JavaScript Objects–properties, references, methods, constructors, Arrays, other built-in objects, Debugging JavaScript, Introduction to Host Objects, Document Object Model (DOM), Document tree, DOM event handling, JQuery, YUI Library                                     | 10                                 | 20         |
| 3              | <b>Server-Side Programming</b><br><b>Java servlet:</b> architecture, life cycle. The Client Request – form data, request headers. The Server Response- HTTP Status Codes, HTTP Response Headers. Sessions, Cookies, URL Rewriting, Concurrency in servlets, <b>Separating Programming and Presentation:</b> Java server pages, Basic JSP, JavaBeans Classes and JSP, JSF, Java Database Connectivity (JDBC), PHP                                | 10                                 | 20         |
| 4              | <b>Content Management Systems</b><br>Introduction to CMS, advantages using CMS, CMS development tools: Wordpress, Drupal, Joomla. Wordpress: content and conversion, directory, file structure, local working, component administration, core, loop, data management, Wordpress as CMS, Wordpress in enterprise. Website Deployment: Domain registration, Domain hosting, parking websites, uploading data using FTP, email configuration. AJAX | 15                                 | 20         |
| 5              | <b>Text and Web Mining</b><br>Text mining: Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Feature vector, Bag of words, Tf-idf, Text Mining Approaches, Web mining: Introduction, web content mining, web usage mining, web structure mining, web crawlers.   | 10                                 | 15         |
| 6              | <b>Web configuration security</b><br>Apache Security, Nginx Security, jBoss Remote Command Execution ,Tomcat RemoteCommand Execution ,HTTP Parameter Pollution  | 5                                  | 10         |
| <b>Total</b>   |   | <b>60</b>                          | <b>100</b> |

### Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

| Level     | Remembrance | Understanding | Application | Evaluate | Create |
|-----------|-------------|---------------|-------------|----------|--------|
| Weightage | 25          | 35            | 10          | 10       | 20     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Course Outcomes

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

|     |  |
|-----|--|
| CO1 | Enhanced ability to design and develop interactive web applications.                 |
| CO2 | Improved understanding of web development languages, frameworks, and tools.          |
| CO3 | Increased proficiency in creating responsive and mobile-friendly web designs.        |
| CO4 | Knowledge of web security principles and practices to protect against cyber threats. |
| CO5 | Improved problem-solving skills through hands-on experience with web technologies.   |
| CO6 | Expanded career opportunities in the rapidly evolving field of web development.      |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Web Technologies : A Computer Science Perspective (TextBook)</b><br>By Jeffrey C.Jackson   Pearson Education, 2nd edition |
| 2. | <b>Java Servlet Programming</b><br>By Jason Hunter   O'reilly Publications, 2nd Edition                                      |



## List of Practical

|    |   |
|----|---|
| 1. | Assume that the information regarding the marks for all the subjects of a student in the last exam are available in a database, Develop a Servlet which takes the enrollment number of a student as a request parameter and displays the marksheet for the student.   |
| 2. | Create two textboxes on the HTML page named login and password. After clicking on i. the 'login' button the servlet will be displayed. It will show 'login successful' upon correct password else 'authentication failure' will be displayed. Make the use of HTTP Servlet or Generic Servlet. ii. Write a program to demonstrate the use of servlet request and response as well as doGet ( ) and doPost( ) methods. |
| 3. | Write a simple JSP page to display a simple message (It may be a simple html page).   |
| 4. | Design a website using Content management system of WordPress. Make the use of different plugins and themes of the WordPress.   |

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|                         |   |                     |
|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Discipline Specific Elective Courses  |                     |
| <b>Prerequisite</b>     | It is expected that students have a strong foundation of RDBMs knowledge, skills, and abilities, including relational algebra, the relational model, normalization, and structure query language. |                     |
| <b>Course Objective</b> | To administer a database by recommending and implementing procedures including database tuning, backup, query processing, query optimization and recovery.  |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W - Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
| 1              | <b>Basic Data base Management System Architecture</b><br><br>History of Data base Systems DBMS structure, DBMS Applications, File System , View of Data ,Data Abstraction , Data base Users and Administrator, Transaction Management , Storage Manager the Query Processor<br><br><b>Need of ER diagrams</b> Database design and ER diagrams, Beyond ER Design Entities, Attributes and Entity sets, Additional features of ER Model, Concept Design with the ER Model ,Conceptual Design for Large enterprises   | 15                                 | 25         |
| 2              | <b>Relational Database Management System</b><br><br>Introduction to the Relational Model, Relationships and Relationship sets, Integrity Constraint Over relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views, altering of Table, Relational Algebra, Selection and projection set operations, renaming, Joins, Division, Examples of Algebra overviews, Relational calculus, Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus   | 10                                 | 25         |
| 3              | <b>Introduction to PL/SQL</b><br><br>Form of Basic SQL Query, Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries Set, Comparison Operators, Aggregative Operators, NULL values, Comparison using NULL values, Logical connectivity's Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active databases, Schema refinement , Problems Caused by redundancy, Decompositions, Problem related to decomposition, Reasoning about FDS, Dependency preserving Decomposition, Schema refinement in Data base Design, Multi valued Dependencies | 25                                 | 30         |
| 4              | <b>Transaction Processing</b><br><br>Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols Multiple Granularity, Recovery and Atomicity, Log Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with loss of nonvolatile storage, Advance Recovery systems, Remote Backup systems   | 10                                 | 20         |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |

| Suggested Distribution Of Theory Marks Using Bloom's Taxonomy |             |               |             |         |          |        |
|---|-------------|---------------|-------------|---------|----------|--------|
| Level   | Remembrance | Understanding | Application | Analyze | Evaluate | Create |
| <b>Weightage</b>  | 20          | 20            | 20          | 10      | 10       | 20     |

  
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*NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.*

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Page 1 of

A handwritten signature in black ink, appearing to read 'Sarbajit'.

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| Course Outcomes   |   |
|---|---|
| <b>At the end of this course, students will be able to:</b> |   |
| CO1   | Understand the development of applications using Programming Language of SQL.         |
| CO2   | Understand the uses the database file and need for create & manage files.             |
| CO3   | Use different types of physical implementation of database to manage transactions     |
| CO4   | Use different types of physical implementation of database and understand ER diagram. |
| CO5   | Exceute SQL queries   |

| Reference Books |   |
|-----------------|---|
| 1.              | <b>Database Systems using ORACLE (TextBook)</b><br>By Nilesh shah   PHI Publication                 |
| 2.              | <b>SQL and Relational Theory</b><br>By C.J.Date   O'Reilly, 2009                                    |
| 3.              | <b>SQL/PLSQL,The Programming Language of ORACLE (TextBook)</b><br>By Ivan Bayross   BPB Publication |



## List of Practical

|     |   |
|-----|---|
| 1.  | Create PL/SQL block to perform arithmetic operations.               |
| 2.  | Implement PL/SQL programs using Control Structure.                  |
| 3.  | Implement PL/SQL program using CURSOR.                              |
| 4.  | Implement PL/SQL program using Exception Handling.                  |
| 5.  | Implement user defined procedures and Function using PL/SQL blocks. |
| 6.  | Implement various Triggers.   |
| 7.  | Practice on Functional Dependencies.                                |
| 8.  | Create stored procedure.  |
| 9.  | Practice on Normalization using various Normal Forms.               |
| 10. | Practice on Transaction Processing.                                 |

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|                         |   |                     |
|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 2</b> |
| <b>Type of Course</b>   | Discipline Specific Elective Courses  |                     |
| <b>Prerequisite</b>     | To start with, basic knowledge of computer networks, digital and analog communications, transmission lines and antennas, digital signal processing and wireless communications will be the prerequisite.                              |                     |
| <b>Course Objective</b> | 1. To study about Wireless networks, protocol stack and standards.<br>2. To study about fundamentals of 3G Services, its protocols and applications.<br>3. To study about evolution of 4G Networks, its architecture and applications |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W - Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
| 1              | <b>Overview of Wireless Networks and Medium Characteristics</b><br>Introduction, Different generations. Introduction to 1G, 2G, 3G and 4G networks Radio propagation mechanism, Path loss modeling, Effects of Multipath and Doppler.  | 10                                 | 15         |
| 2              | <b>Physical Layer and Medium Access Alternatives</b><br>Short distance base band transmission, Ultra Wide-Band pulse transmission, Carrier modulated transmission, Digital cellular transmission, Broadband and Spread Spectrum transmission. Diversity and Smart receiving techniques. Fixed assignment access for voice oriented networks, Random access for data oriented networks. | 15                                 | 25         |
| 3              | <b>Wireless Network Planning and Operation</b><br>Wireless network topologies, Cell fundamentals and topologies, Signal to Interference ratio calculation, Capacity expansion techniques. Network planning for CDMA systems. Mobility management, Mobile internet protocols, Radio resources and power management, Security in wireless networks.                                      | 15                                 | 25         |
| 4              | <b>GSM, TDMA, CDMA technology and Mobile Data networks</b><br>Mechanism to support mobile environment, Communication infrastructure. Reference architecture for North American Systems, IS-95, IMT -2000. GPRS and higher data rates, Short messaging services in GSM, Mobile application protocols  | 10                                 | 20         |
| 5              | <b>Wireless Broad band and Ad-hoc networks</b><br>IEEE 802.11 WLANs, Ad-Hoc networking, Bluetooth, WPANs, WiMax technology. Wireless Geo location Systems.   | 10                                 | 15         |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |

| Suggested Distribution Of Theory Marks Using Bloom's Taxonomy |             |               |             |         |        |
|---|-------------|---------------|-------------|---------|--------|
| Level   | Remembrance | Understanding | Application | Analyze | Create |
| <b>Weightage</b>  | 20          | 20            | 20          | 10      | 30     |

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.



### Course Outcomes

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

|     |  |
|-----|--|
| CO1 | Understanding of the fundamental concepts of wireless communication.   |
| CO2 | Studying mobile radio system, characteristics of radio waves, Radio propagation, wireless system                         |
| CO3 | Studying wireless system and wireless data networking  |
| CO4 | Analyse basics of mobile network layer and mobile transport layer.   |
| CO5 | Analyse security, energy efficiency, mobility, scalability and unique characteristics in Wireless Communication Network. |
| CO6 | Demonstrate basic skills for cellular network design.  |

### Reference Books

|    |  |
|----|--|
| 1. | <b>Wireless Communications and Networks : 3G and beyond (TextBook)</b><br>By Iti Saha Misra   Tata McGraw Hill                             |
| 2. | <b>Mobile Computing Technology : Application and Service Creation (TextBook)</b><br>By Asoke K Talukder Roopa R Yavagal   Tata McGraw Hill |
| 3. | <b>Wireless Communications : Principles and Practice</b><br>By Theodore S. Rappaport   Pearson   |

### List of Practical

|    |  |
|----|--|
| 1. | Setup & Configuration of Wireless Access Point (AP)          |
| 2. | Study of WLAN: Ad Hoc & Infrastructure Mode                  |
| 3. | Study of Bluetooth Protocol and Applications                 |
| 4. | GSM modem study (Nokia 30) and SMS client-server application |
| 5. | Mobile Internet and WML                                      |
| 6. | J2ME Program for Mobile Node Discovery                       |
| 7. | Mobile protocol study using omnet++                          |
| 8. | Wireless Network Security: kismet and Netstumbler            |

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|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 3</b> |
| <b>Type of Course</b>   | Core Courses   |                     |
| <b>Prerequisite</b>     | Two key formal language specifications for making and connecting assertions about the world comprise the foundational building blocks of the semantic web: the Resource Definition Framework (RDF) and Ontology Web Language (OWL).  |                     |
| <b>Course Objective</b> | The Semantic Web aims to enrich the Web with a layer of machine-interpretable metadata so that computer programs can predictably derive new information. This goal will require the development of metadata syntax and vocabularies, and the creation of metadata for lots of Web pages. |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 3                               | 0        | 2   | 4      | 70                | 30  | 50  | 150         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W - Weightage |            |
|----------------|--|------------------------------------|------------|
| Sr.            | Topics   | T                                  | W          |
| 1              | <b>Introduction and Vision</b><br>Modern Web, Introduction to Ontologies, Ontology languages for Semantic Web, Semantic web technologies, Layered approach, Applications of Semantic Web Technologies.   | 12                                 | 20         |
| 2              | <b>Structured Web Documents &amp; Web Resources:</b><br>XML, RDF: The XML language, Structuring, Namespaces, Querying and Addressing XML documents, Processing, Introduction, RDF, RDF Schema syntax and language, Direct Inference System, Querying RQL | 12                                 | 20         |
| 3              | <b>Web Ontology Language, Knowledge Representation.</b><br>Introduction, OWL language, Examples, Knowledge Representation: Languages - Formalisms, Logics - Semantic Networks, Frame- Based KR, and Description Logics, Future extensions.               | 11                                 | 20         |
| 4              | <b>Discovering Information</b><br>Introduction, Querying, Monotonic Rules syntax, semantics & examples, Non-monotonic rules – syntax & examples, Encoding in XML   | 12                                 | 20         |
| 5              | <b>Semantic Web Applications &amp; Case Studies</b><br>Description Logic, e-Learning, Web Services, Building Semantic Web Applications, Other Scenarios.   | 13                                 | 20         |
| <b>Total</b>   |  | <b>60</b>                          | <b>100</b> |

| Course Outcomes   |  |
|---|--|
| <b>At the end of this course, students will be able to:</b> |  |
| CO1   | Ability to understand and apply the principles and technologies of the Semantic Web.                                   |
| CO2   | Proficiency in creating and querying RDF (Resource Description Framework) data.  |
| CO3   | Skill in using ontology languages such as OWL (Web Ontology Language) for knowledge representation.                    |
| CO4   | Knowledge of Semantic Web standards and protocols, including SPARQL for querying RDF data                              |
| CO5   | Ability to develop and integrate semantic web applications for improved data interoperability and knowledge discovery. |





## Reference Books

|    |   |
|----|---|
| 1. | <b>A Semantic web Primer (TextBook)</b><br>By Grigoris Antoniou and Frank Van Hermelen   MIT Press                    |
| 2. | <b>Foundations of Semantic Web Technologies</b><br>By Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph,   CRC Press |
| 3. | <b>Semantic Web programming (TextBook)</b><br>By John Hebleret.el   Wiley   |

## List of Practical

|    |   |
|----|---|
| 1. | Create an XML file defining an article in newspaper.  |
| 2. | Create an XML file containing list of students. Also create stylesheet file to display list in an HTML format.  |
| 3. | Create an XML file containing list of students. Using XPath display following information Information of a student with ID No :<br>1. The entire student in the sorted order according to their CGPA. |
| 4. | Study of RDF (Resource Description Framework)   |
| 5. | Prepare case study for Semantic Web Applications.   |

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|-------------------------|---|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)  | <b>Semester - 3</b> |
| <b>Type of Course</b>   | Core Courses  |                     |
| <b>Prerequisite</b>     | Ensure students have the foundational knowledge and skills required to succeed in the HPC course.   |                     |
| <b>Course Objective</b> | Equip students with the skills and knowledge necessary to effectively utilize and optimize High Performance Computing systems for solving complex computational problems. |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 0                               | 0        | 10  | 10     | 0                 | 0   | 300 | 300         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |   | T - Teaching Hours   W - Weightage |            |
|----------------|---|------------------------------------|------------|
| Sr.            | Topics  | T                                  | W          |
| 1              | <p><b>Dissertation Phase-1 Guidelines To remember</b></p> <p><b>1. Literature Review:</b></p> <ul style="list-style-type: none"> <li><b>Objective:</b> Develop a comprehensive understanding of existing research related to your topic.</li> <li><b>Content:</b> Summarize key theories, models, and findings; identify gaps in the current knowledge base.</li> <li><b>Structure:</b> Introduction, thematic or chronological review, critical analysis, conclusion.</li> </ul> <p><b>2. Problem Formulation:</b></p> <ul style="list-style-type: none"> <li><b>Objective:</b> Clearly define the research problem or question.</li> <li><b>Content:</b> Statement of the problem, justification of significance, specific research questions or hypotheses.</li> <li><b>Structure:</b> Background, problem statement, importance, research questions or hypotheses.</li> </ul> <p><b>3. Progress:</b></p> <ul style="list-style-type: none"> <li><b>Objective:</b> Document work completed so far.</li> <li><b>Content:</b> Summary of completed activities, key findings, challenges encountered.</li> <li><b>Structure:</b> Introduction, description of tasks, results and findings, discussion of challenges.</li> </ul> <p><b>4. Work Plan:</b></p> <ul style="list-style-type: none"> <li><b>Objective:</b> Outline the remaining work and timeline.</li> <li><b>Content:</b> Detailed plan for remaining tasks, milestones, deadlines, required resources.</li> <li><b>Structure:</b> Introduction, list of tasks with deadlines, timeline (e.g., Gantt chart), required resources.</li> </ul> <p><b>Formatting and Submission Requirements:</b></p> <ul style="list-style-type: none"> <li><b>Format:</b> Follow institutional guidelines (font, spacing, margins, etc.).</li> <li><b>Length:</b> Ensure sections are thorough but concise.</li> <li><b>References:</b> Properly cite all sources.</li> <li><b>Submission:</b> Submit by the specified deadline for review.</li> </ul> |                                    | 100        |
| <b>Total</b>   |   |                                    | <b>100</b> |

|                         |  |                     |
|-------------------------|--|---------------------|
| <b>Course</b>           | Master of Technology (M.Tech.)   | <b>Semester - 4</b> |
| <b>Type of Course</b>   | Core Courses   |                     |
| <b>Prerequisite</b>     | Ensure students have the necessary background to engage effectively with research methodologies and data analysis techniques.  |                     |
| <b>Course Objective</b> | Provide students with a comprehensive understanding of research methodologies, data collection techniques, and preliminary data analysis to effectively conduct and evaluate research. |                     |

| Teaching Scheme (Contact Hours) |          |     |        | Assessment Scheme |     |     |             |
|---------------------------------|----------|-----|--------|-------------------|-----|-----|-------------|
| Lecture                         | Tutorial | Lab | Credit | Theory Marks      |     | LAB | Total Marks |
|                                 |          |     |        | SEE               | CIA |     |             |
| 0                               | 0        | -   | 20     | 0                 | 0   | 400 | 400         |

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

| Course Content |  | T - Teaching Hours   W - Weightage |     |
|----------------|--|------------------------------------|-----|
| Sr.            | Topics   | T                                  | W   |
| 1              | <p><b>Guidelines For Phase-II</b></p> <p><b>1. Research Methodology:</b></p> <ul style="list-style-type: none"> <li><b>Objective:</b> Detail the research design and methods used to address the research problem.</li> <li><b>Content:</b> <ul style="list-style-type: none"> <li>Research design (e.g., qualitative, quantitative, mixed methods)</li> <li>Sampling methods and sample size</li> <li>Data collection techniques (e.g., surveys, interviews, experiments)</li> <li>Tools and instruments used (e.g., questionnaires, software)</li> <li>Data analysis methods (e.g., statistical analysis, thematic analysis)</li> </ul> </li> </ul> <p><b>2. Data Collection:</b></p> <ul style="list-style-type: none"> <li><b>Objective:</b> Collect data relevant to the research problem using the outlined methods.</li> <li><b>Content:</b> <ul style="list-style-type: none"> <li>Description of the data collection process</li> <li>Instruments and tools used</li> <li>Challenges and how they were addressed</li> <li>Ethical considerations</li> </ul> </li> </ul> <p><b>3. Preliminary Analysis:</b></p> <ul style="list-style-type: none"> <li><b>Objective:</b> Conduct an initial analysis of the collected data to identify trends, patterns, and insights.</li> <li><b>Content:</b> <ul style="list-style-type: none"> <li>Data cleaning and preparation</li> <li>Initial statistical or thematic analysis</li> <li>Key findings and observations</li> <li>Interpretation of preliminary results</li> </ul> </li> </ul> <p><b>4 Formatting and Submission Requirements:</b></p> <ul style="list-style-type: none"> <li><b>Format:</b> Follow institutional guidelines (font, spacing, margins, etc.).</li> <li><b>Length:</b> Ensure sections are thorough but concise.</li> <li><b>References:</b> Properly cite all sources.</li> <li><b>Submission:</b> Submit by the specified deadline for review.</li> </ul> |                                    | 100 |

|  |              |            |
|--|--------------|------------|
|  | <b>Total</b> | <b>100</b> |
|--|--------------|------------|



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