

## DESIGN AND ANALYSIS OF ALGORITHMS

<u>TEACHING SCHEME:</u>	<u>EXAMINATION SCHEME:</u>	<u>CREDITS ALLOTTED:</u>
Lectures: 3 Hrs./Week	Semester Examination: 60 marks	Theory: 3 Credits
Tutorials: NA	Continuous Assessment: 40 marks	Term Work and Practical Credit: 1
Lab: 2 Hrs./Week	Term Work and Practical: 50	

**Course Pre Requisites:** Students should be well versed with algorithms and operations on basic data structures stacks, queues, linked lists, trees, graphs. Students should have knowledge of searching sorting algorithms.

**Course Objective:** Understand and compare important algorithmic design paradigms and methods of analysis. To choose and extend efficient algorithms required for designs.

### Course Outcomes:

After successful completion of this course students will be able to :

1. Interpret the performance of algorithms using analysis techniques.
2. Examine the fundamental algorithmic strategies.
3. Compare the fundamental algorithmic strategies.
4. Implement Graphs and trees algorithms.
5. Interpret the tractable or intractable problem.
6. Summarize the advance types of algorithms.

### Topics to Be Covered:

#### UNIT – I [6 Hours]

**Introduction:** Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters’ Theorem.

#### UNIT – II [6 Hours]

**Fundamental Algorithmic Strategies:** Brute-Force technique, Heuristics, Greedy algorithms, , Illustrations of these techniques for Problem-Solving

#### UNIT – III [6 Hours]

**Fundamental Algorithmic Strategies (contd.) :** Dynamic Programming, Branch and Bound algorithms, Backtracking methodologies; Illustrations of these techniques for Problem-Solving

#### UNIT – IV [6 Hours]

**Graph and Tree Algorithms:** Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

#### UNIT – V [6 Hours]

**Tractable and Intractable Problems:** Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook’s theorem, Standard NP-complete problems and Reduction techniques.

#### UNIT – VI [6 Hours]

**Advanced Topics:** Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.

#### Home Assignments:

Implementation of Different Algorithms based on various algorithmic strategies studied above using C

#### Text Books:

1. *Fundamental of Computer Algorithms*, E. Horowitz and S. Sahni, Orient Black Swan
2. *Introduction to Algorithms*, T. H. Cormen, C. E. Leiserson and R. L. Rivest, PHI Learning Pvt. Ltd. (Originally MIT Press)

#### Reference Books:

1. *The Design and Analysis of Computer Algorithms*, A. Aho, J. Hopcroft and J. Ullman, Pearson Education India
2. *Computer Algorithms: Introduction to Design and Analysis*, S. Baase, Pearson Education India
3. *The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3*, .D. E. Knuth, Addison Wesley

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

## Compiler Design

<b><u>TEACHING SCHEME:</u></b>	<b><u>EXAMINATION SCHEME:</u></b>	<b><u>CREDITS ALLOTTED:</u></b>
<b>Lectures: 3 Hrs/Week</b>	<b>Semester Examination: 60 marks</b>	<b>Theory: 3 Credits</b>
<b>Tutorials: Nil</b>	<b>Continuous Assessment: 40 marks</b>	<b>Term Work and Practical Credit: 1</b>
<b>Lab: 2Hrs/Week</b>	<b>Term Work and Practical: 50</b>	

### Course Pre Requisites:

1. The students should have learnt Theory of Computation.
2. Basic of the structure of any Programming Language and Grammars.
3. Know the basics of Computer organization and Assembly Language Programming.

### Course Objective:

1. To study the Compiler Design Tools.
2. To understand the Compiler for various Programming Languages.

### Course Outcomes:

1. Understands compiler and various phases in compilation.
2. Understand Parser and its various techniques.
3. Understands Syntax Directed Translation, Symbol Tables and their applications.
4. Learn the techniques of Code Optimization.
5. Learn the techniques of Code improvement.
6. Understands compilation of Object Oriented features.

### Topics to Be Covered:

#### UNIT – I [6 Hours]

**Introduction:** Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).

#### UNIT – II [6 Hours]

**Syntax Analysis (Parser):** Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

### UNIT – III [6 Hours]

**Semantic Analysis:** Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.

**Symbol Table:** Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope.

### UNIT – IV [6 Hours]

**Intermediate Code Generation:** Translation of different language features, different types of intermediate forms

**Code Improvement (optimization):** Control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.

### UNIT – V [6 Hours]

**Architecture dependent code improvement:** Instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.

### UNIT – VI [6 Hours]

**Advanced topics:** Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

#### Home Assignments:

Assignments using Lex and Yacc

#### Text Books:

1. Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. Ullman.
2. Lex & Yacc, Levine R. John, Tony Mason and Doug Brown

#### Reference Books:

The Design and Evolution of C++, Bjarne Stroustrup.

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## FUNDAMENTALS OF MANAGEMENT

<b><u>TEACHING SCHEME:</u></b>	<b><u>EXAMINATION SCHEME:</u></b>	<b><u>CREDITS ALLOTTED:</u></b>
<b>Lectures: 4 Hrs/Week</b>	<b>Semester Examination: 60 marks</b>	<b>Theory: 4 Credits</b>
<b>Tutorials: NIL</b>	<b>Continuous Assessment: 40 marks</b>	<b>Term Work and Practical Credit: NIL</b>
<b>Lab: NIL</b>	<b>Term Work and Practical: Nil</b>	

**Course Pre Requisites:** Preliminary awareness about the functioning of any organization

**Course Objective:**

1. To impart knowledge about various management and organization principles which governs the functioning of a firm/organization
2. To explain about concepts of leadership, organizational design, organization behavior and managerial ethics.

**Course Outcomes:** After completion of course, students should be able to

7. Understand the evolution of management
8. Explain intricacies of different functions of management.
9. Categorize behavior of individuals in an organization
10. Distinguish between approaches to organizational design.
11. Analyze importance and types of work ethics
12. Identify importance and traits of leadership

**Topics to Be Covered:**

**UNIT – I [6 Hours]**

**Management Theories:** Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

**UNIT – II [6 Hours]**

**Functions of Management-** Planning, Organizing, Staffing, Directing, Controlling

**UNIT – III [6 Hours]**

**Organization Behavior:** Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity

**UNIT – IV [6 Hours]**

**Organizational Design:** Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)

**UNIT – V [6 Hours]**

**Managerial Ethics:** Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision – making frameworks, Business and Social Responsibility, International Standards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility

**UNIT – VI [6 Hours]**

**Leadership:** Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid.

**Home Assignments:** The topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

1. Topic: Corporate social responsibility (CSR) and HRM implications: What does it mean to be socially responsible within an increasingly financially driven market economy?
2. Topic: Leaders are Born, Not Made! The debate

**Text Books:** Richard L. Daft, *Understanding the Theory and Design of Organizations*

**Reference Books:**

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, *Organizational Behavior*
2. Other relevant articles or books could be sent later to the students.

<b>Syllabus for Unit Test:</b>	
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## **BUSINESS STRATEGY**

<b><u>TEACHING SCHEME:</u></b>	<b><u>EXAMINATION SCHEME:</u></b>	<b><u>CREDITS ALLOTTED:</u></b>
<b>Lectures: 3 Hrs./Week</b>	<b>Semester Examination: 60 marks</b>	<b>Theory: 3 Credits</b>
<b>Tutorials: NIL</b>	<b>Continuous Assessment: 40 marks</b>	<b>Term Work and Practical credit: NIL</b>
<b>Lab: NIL</b>	<b>Term Work and Practical: NIL</b>	

**Course Pre Requisites:** Introductory awareness of Business terminologies and functions

**Course Objective:** Familiarize the fundamental principles and practices of business development

**Course Outcomes:**

This course will help students,

13. To summarize the important concepts of strategic management
14. To identify the process and capabilities for internal environment of a firm.
15. To understand the strategies applicable for external environments of firm
16. To examine corporate strategies
17. To compare the various business growth strategies
18. To understand the process of strategy implementation

**Topics to Be Covered:**

### **UNIT – I [6 Hours]**

**Introduction to Strategic Management**

- Importance of Strategic Management
- Vision and Objectives
- Schools of thought in Strategic Management
- Strategy Content, Process, and Practice
- Fit Concept and Configuration Perspective in Strategic Management

### **UNIT – II [6 Hours]**

**Internal Environment of Firm- Recognizing a Firm's Intellectual Assets**

- Core Competence as the Root of Competitive Advantage
- Sources of Sustained Competitive Advantage
- Business Processes and Capabilities-based Approach to Strategy

### **UNIT – III [6 Hours]**

#### **External Environments of Firm- Competitive Strategy**

- Five Forces of Industry Attractiveness that Shape Strategy
- The concept of Strategic Groups, and Industry Life Cycle
- Generic Strategies
- Generic Strategies and the Value Chain
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### **UNIT – IV [6 Hours]**

#### **Corporate Strategy**

- The Motive for Diversification
- Related and Unrelated Diversification
- Business Portfolio Analysis

### **UNIT – V [6 Hours]**

#### **Growth Strategies**

- Expansion, Integration and Diversification
- Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

### **UNIT – VI [6 Hours]**

#### **Strategy Implementation: Structure and Systems**

- The 7S Framework
- Strategic Control and Corporate Governance

#### **Home Assignments:**

- Latest business events would be discussed in class and students should be ready to discuss these events (in groups). The topic will be mentioned beforehand. Students are required to meet in groups before coming to class and prepare on the topic.
- There will be periodic homework assignments relating to the course concepts or mini-cases. Specific instructions will be given separately.

#### **Text Books:**

1. Robert M. Grant (2012). *Contemporary Strategic Management*, Blackwell, 7th Edition.

#### **Reference Books:**

1. M.E. Porter, *Competitive Strategy*, 1980. M.E. Porter,
2. *Competitive Advantage*, 1985 Richard Rumelt (2011).  
*Good Strategy Bad Strategy: The Difference and Why It Matters.*



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## DESIGN THINKING

<u>TEACHING SCHEME:</u>	<u>EXAMINATION SCHEME:</u>	<u>CREDITS ALLOTTED:</u>
<b>Lectures: 3Hrs./Week</b>	<b>Semester Examination: 60 marks</b>	<b>Theory: 3 Credits</b>
<b>Tutorials: NA</b>	<b>Continuous Assessment: 40 marks</b>	<b>Term Work credit: 1</b>
<b>Lab: 2Hrs./Week</b>	<b>Term Work and Oral: 50</b>	

**Course Pre Requisites:** Students should be well versed with the concepts from all nits from Semesters I, II, III and IV.

### Course Objective:

1. Recognize the importance of design thinking.
2. Explain the phases in the design thinking process.
3. List the steps required to complete each phase in design thinking process
4. Apply each phase in the design thinking process.
5. Use doodling and storytelling in presenting ideas and prototypes
6. Create value proposition statements as part of their presentations
7. Recognize how design thinking can help in functional work
8. Recognize how Agile and design thinking complement each other to deliver customer satisfaction

### Course Outcomes:

After successful completion of this course students will be able to:

1. Implement the Phases in the DT process
2. Identify the steps required to conduct an immersion activity
3. Design personas to create problem statements in the define phase of DT
4. Apply the steps in the ideate phase of DT

5. Design a prototype to create a value proposition statement
6. Test a prototype created through a DT process

**Topics to Be Covered:**

**UNIT – I [6 Hours]**

**Introduction:** Recognize the importance of Design Thinking (DT) why is Design Thinking important for business?, Why is Design Thinking important for you?, Identify the steps in the DT process, What is DT? Empathize (search for rich stories and find some love), Define (user need and insights – their POV), Ideate (ideas, ideas, ideas), Prototype (build to learn), Test (show, don't tell)

**UNIT – II [6 Hours]**

**Empathy Phase:** Recognize the steps in the empathize phase of DT, What is empathy? Ask What? How? Why?, Different types to developing Empathy towards People Identify the steps required to conduct an immersion activity, How to empathize?, Introduction to Immersion Activity, Conduct an immersion activity and fill up the DT question template, Immersion activity

**UNIT – III [6 Hours]**

**Define Phase:** Creating personas: Recognize the steps to create personas in the define phase of DT, What is a persona and how do I create one? Four Different Perspectives on Personas 1)Goal-directed Personas 2)Role-Based Personas 3) Engaging Personas 4) Fictional Personas, 10 steps to Creating Your Engaging Personas and Scenarios Recognize the steps to create problem statements in the define phase of DT, Problem statements, Defining problem statements, Define the problem statements in the define phase of DT

**UNIT – IV [6 Hours]**

**Ideate Phase:** How to Ideate?, Recognize the steps in the ideate phase of DT, Apply the steps in the ideate phase of DT, Ideation games: Game 1: Six Thinking Hats, Game 2: Million-dollar idea, Ideate to find solutions, Characteristics Required for Successful Ideation, Recognize how doodling can help to express ideas, Recognize the importance storytelling in presenting ideas and prototypes, What is Storytelling in DT?

**UNIT – V [6 Hours]**

**Prototype phase:** Recognize the importance of the prototype phase in DT, Prototype your idea, Create a prototype: Types of Prototyping 1) Low-Fidelity Prototyping 2) High-Fidelity Prototyping, Guidelines for Prototyping, Recognize the importance of service value proposition, Create a value proposition statement

**UNIT – VI [6 Hours]**

**Testing Phase:** Testing in Design Thinking, Test the Prototype, Role of DT in your work, discuss How DT can help me to become a better coder?, Agile and DT complement each other to deliver customer satisfaction, Share your Satori.

**Home Assignments:**

Implementation of Different Design Thinking Phase based on various activities.

**Text Books:**

1. Design Thinking business innovation by author Maurício Vianna Ysmar Vianna Isabel K. Adler Brenda Lucena Beatriz Russo <http://www.designthinkingbook.com>
2. The Basics of User Experience Design by interaction design foundation

**Reference Books:**

- Hooked by Nir Eyal
- The Art of Creative Thinking by Rod Judkins
- Start Up nation by Dan Senior and Saul singer
- Start with Why by Simon Sinek

**Web References:**

1. <https://www.interaction-design.org/literature/article/stage-1-in-the-design-thinking-process-empathise-with-your-users>
2. <https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them>

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## Practical

### Summative Assessment based on End Semester Project

Bloom's Level	Topics	Contents		Marks
Understand	Understand, Analyze, Apply	<p><b>Option 1:</b> Each group needs to present a Prototype of how they can apply DT in their functional work or coding. Examples will be provided to explain what exactly they need to do.</p> <p><b>Option 2:</b> Each group will apply DT to create a prototype to improve any existing product or service.</p> <p>For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their presentation.</p>		50
Apply	Conduct and apply DT in the project.		<b>12 Hours</b>	
Analyze				

### Elective -I Machine Learning

<b><u>TEACHING SCHEME:</u></b>	<b><u>EXAMINATION SCHEME:</u></b>	<b><u>CREDITS ALLOTTED:</u></b>
<b>Lectures: 3Hrs./Week</b>	<b>Semester Examination: 60 marks</b>	<b>Theory: 4 Credits</b>
<b>Tutorials: 1Hr./Week</b>	<b>Continuous Assessment: 40 marks</b>	<b>Term Work and Oral Credit: 1</b>
<b>Lab: 2 Hrs./Week</b>	<b>Term Work and Oral: 50</b>	

#### Course Pre-Requisites:

- 1) Basic concepts of statistics.
- 2) Knowledge of fundamentals of AI.

#### Course Objective:

- 1) To simulate decision making and thinking in machine.
- 2) To understand standard Machine Learning practices.
- 3) To apply algorithms for precise result.

#### Course Outcomes: Students will be able to

19. Learn relationship between human and machine.
20. Implement basic classification algorithms
21. Implement enhanced classification algorithms
22. Implement HMM in detail
23. Apply concepts of regression for various application
24. Apply expectation maximization techniques for optimization.

#### Topics to Be Covered:

##### UNIT – I

[6 Hours]

Introduction to Machine Learning (ML); Relationship between ML and human learning; A quick survey of major models of how machines learn; Example applications of ML

##### UNIT – II

[6 Hours]

Classification: Supervised Learning; The problem of classification; Feature engineering; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1-measure, accuracy, area under curve); Statistical decision theory including discriminant functions and decision surfaces.

### **UNIT – III**

**[6 Hours]**

Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines; Artificial neural networks including backpropagation; Applications of classifications; Ensembles of classifiers including bagging and boosting.

### **UNIT – IV**

**[6 Hours]**

Hidden Markov Models (HMM) with forward-backward and Viterbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging.

### **UNIT – V**

**[6 Hours]**

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression Association rule mining algorithms including apriori.

### **UNIT – VI**

**[6 Hours]**

Expectation-Maximization (EM) algorithm for unsupervised learning Clustering: average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbors clustering; BIRCH; CURE; DBSCAN Anomaly and outlier detection methods.

#### **Home Assignments:**

- (1) Introduction to WEKA and R
- (2) Classification of some public domain datasets in UCI ML repository

#### **Mini projects in the Lab:**

- (1) Implementation of one clustering algorithm
- (3) Implementation of one association rule mining algorithm
- (4) Implementation of one anomaly detection algorithms
- (5) Implementation of EM algorithm for some specific problem

#### **Text Books:**

[1] R.O. Duda, P.E. Hart, D.G. Stork, **Pattern Classification**, 2/e, Wiley, 2001.

#### **Reference Books:**

- [1] C. Bishop, **Pattern Recognition and Machine Learning**, Springer, 2007.
- [2] E. Alpaydin, **Introduction to Machine Learning**, 3/e, Prentice-Hall, 2014.
- [3] A. Rostamizadeh, A. Talwalkar, M. Mohri, **Foundations of Machine Learning**, MIT Press.
- [4] A. Webb, **Statistical Pattern Recognition**, 3/e, Wiley, 2011.

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