Faculty of Science & Technology
Savitribai Phule Pune University,
Pune, Maharashtra, India

Curriculum For
Third Year of Information Technology
(2019 Course)
(With effect from AY 2021-22)
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### Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

#### Savitribai Phule Pune University, Pune

**Bachelor of Information Technology**

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<td><strong>PO1</strong> Engineering knowledge</td>
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<td><strong>PO2</strong> Problem analysis</td>
</tr>
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<td><strong>PO3</strong> Design / Development of Solutions</td>
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<td><strong>PO4</strong> Conduct Investigation of Complex Problems</td>
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<td><strong>PO5</strong> Modern Tool Usage</td>
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<td><strong>PO6</strong> The Engineer and Society</td>
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</tr>
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<td><strong>PO12</strong> Life-long Learning</td>
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<tr>
<td>Program Specific Outcomes (PSO)</td>
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<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>A graduate of the Information Technology Program will demonstrate—</td>
</tr>
<tr>
<td><strong>PSO1</strong></td>
</tr>
<tr>
<td>An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.</td>
</tr>
<tr>
<td><strong>PSO2</strong></td>
</tr>
<tr>
<td>An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.</td>
</tr>
<tr>
<td><strong>PSO3</strong></td>
</tr>
<tr>
<td>An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities.</td>
</tr>
<tr>
<td><strong>PSO4</strong></td>
</tr>
<tr>
<td>Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.</td>
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SEMESTER – V
### Savitribai Phule Pune University

**Third Year of Information Technology (2019 course)**

*With effect from Academic Year 2021-22*

#### Semester-V

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<th>Teaching Scheme (Hours/week)</th>
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<td>Theory Practical Tutorial Mid-Sem End-Sem Term work Practical Oral Total Lecture Practical Tutorial Total</td>
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<td>314441</td>
<td>Theory of Computation</td>
<td>03 - -</td>
<td>30 70 - - - 100</td>
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<td>314442</td>
<td>Operating Systems</td>
<td>03 - -</td>
<td>30 70 - - - 100</td>
<td>3 - - 3</td>
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<tr>
<td>314443</td>
<td>Machine Learning</td>
<td>03 - -</td>
<td>30 70 - - - 100</td>
<td>3 - - 3</td>
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<td>Human Computer Interaction</td>
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<td>30 70 - - - 100</td>
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<td>Elective-I</td>
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**Total Credit:** 15 06 - 21

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**Abbreviations:**

TH: Theory, TW: Term Work, PR: Practical, OR: Oral, TUT: Tutorial

**Elective-I:**
- 314445A: Design and Analysis of Algorithm
- 314445B: Advanced Database and Management System
- 314445C: Design Thinking
- 314445D: Internet of Things

**Audit Course 5:**
- 314450A: Banking and Insurance
- 314450B: Startup Ecosystems
- 314450C: Foreign Language—(Japanese Language- III)

**Laboratory Practice-I:**

Assignment from Machine Learning and Elective I

**Note:** Students of T.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)
# Savitribai Phule Pune University
## Third Year of Information Technology (2019 Course)
(With effect from Academic Year 2021-22)

### Semester-VI

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<th>Course Code</th>
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<th>Teaching Scheme (Hours/week)</th>
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<td>314451</td>
<td>Computer Networks &amp; Security</td>
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<td>314452</td>
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<td>Elective-II</td>
<td>03 - - 30 70 - - -</td>
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**Total** 12 09 - 21

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<tr>
<th>Course Code</th>
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<td>314454B</td>
<td>Cyber Security</td>
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<td>314454C</td>
<td>Cloud Computing</td>
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<td>314454D</td>
<td>Software Modeling and Design</td>
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**Laboratory Practice-II:**
Assignments from Web Application Development and Elective-II.

**Note:** Students of T.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

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**Abbreviations:** TH: Theory, TW: Term Work, PR: Practical, OR: Oral, TUT: Tutorial
### Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

#### 314441: Theory of Computation

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<td>Theory (TH) : 3 hrs/week</td>
<td>03 Credits</td>
<td>Mid_Semester : 30 Marks</td>
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<td>End_Semester : 70 Marks</td>
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**Prerequisite Courses:**
1. Discrete Structures.
2. Data structures.

**Companion Course, if any:** NA

**Course Objectives:**
1. To know the applicability of the model of computation to different problems.
2. To understand in detail the relationship among formal languages, formal grammars and automata.
3. To learn the design of Finite Automata, Pushdown Automata and Turing Machine for processing of formal languages.
4. To study the theory of computability and complexity for algorithm design.

**Course Outcomes:**
On completion of the course, students will be able to–

- **CO1:** Construct finite automata and its variants to solve computing problems.
- **CO2:** Write regular expressions for the regular languages and finite automata.
- **CO3:** Identify types of grammar, design and simplify Context Free Grammar.
- **CO4:** Construct Pushdown Automata machine for the Context Free Language.
- **CO5:** Design and analyze Turing machines for formal languages.
- **CO6:** Understand decidable and undecidable problems, analyze complexity classes.

#### COURSE CONTENTS

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<th>Unit</th>
<th>FINITE AUTOMATA</th>
<th>( 06 hrs )</th>
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<td>Finite Automata (FA):</td>
<td>Formal definition and notations for FSM, Concept of state transition diagram and transition table for FA, Construction of DFA, NFA, NFA with epsilon moves. Conversion of NFA with epsilon moves to NFA, Conversion of NFA to DFA, and Conversion of NFA with epsilon moves to DFA, Minimization of FA, Equivalence of FAs, and Applications of FA.</td>
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<tr>
<td>Finite State Machine with output:</td>
<td>Moore and Mealy machines - Definition, Construction, Inter-Conversion.</td>
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<th>Unit II</th>
<th>REGULAR EXPRESSIONS AND LANGUAGES</th>
<th>( 06 hrs )</th>
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<tr>
<td>Regular Expressions (RE) :</td>
<td>Definition and Identities of RE, Operators of RE, Equivalence of two regular expressions, Equivalence of regular expressions and regular languages (RL), Conversion of RE to FA using direct method, Conversion of FA to RE using Arden’s theorem, Pumping lemma for RLs, Closure properties of RLs, Applications of Regular Expressions.</td>
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**Savitribai Phule Pune University, Pune**

**Third Year Information Technology (2019 Course)**

**TE (Information Technology) Syllabus (2019 Course)** 9
Mapping of Course Outcomes for Unit II

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<tr>
<th>Unit III</th>
<th>CONTEXT FREE GRAMMAR AND LANGUAGE</th>
<th>(06 hrs)</th>
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Grammar: Introduction and representation, Chomsky Hierarchy, Formal definition of Regular Grammar(RG), Conversions: LRG to RLG, RLG to LRG, RG to FA, FA to RG.


Grammar Simplification, Normal forms: Chomsky Normal Form, Greibach Normal Form. Closure properties of CFL, Pumping lemma for CFL.

Mapping of Course Outcomes for Unit III

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<th>Unit IV</th>
<th>PUSHDOWN AUTOMATA AND POST MACHINE</th>
<th>(06 hrs)</th>
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Pushdown Automata(PDA) : Introduction and formal definition of PDA, Construction of Transition diagram and Transition table for PDA, Instantaneous Description of PDA, Equivalence of Acceptance by Final State & Empty stack, Deterministic PDA and Nondeterministic PDA, Context Free Language and PDA, Conversion of CFG to PDA and PDA to CFG.


Mapping of Course Outcomes for Unit IV

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<th>TURING MACHINE</th>
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Mapping of Course Outcomes for Unit V

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<th>Unit VI</th>
<th>COMPUTATIONAL COMPLEXITY</th>
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Decidability: Decidable problems concerning regular languages, Decidable problems concerning context free languages, Un-decidability.

# Mapping of Course Outcomes for Unit VI

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NPTEL video lecture link: |
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<tbody>
<tr>
<td>1. <a href="https://nptel.ac.in/courses/106/104/106104148/">https://nptel.ac.in/courses/106/104/106104148/</a></td>
</tr>
<tr>
<td>2. <a href="https://nptel.ac.in/courses/106/104/106104028/">https://nptel.ac.in/courses/106/104/106104028/</a></td>
</tr>
</tbody>
</table>
### 314442: Operating Systems

**Teaching Scheme:** Theory (TH) : 3 hrs/week

**Credit Scheme:** 03 Credits

**Examination Scheme:**
- Mid_Semester : 30 Marks
- End_Semester : 70 Marks

#### Prerequisite Courses:
1. Computer Organization and Architecture
2. Fundamentals of Data Structures

**Companion Course, if any:** NA

#### Course Objectives:
1. To introduce basic concepts and functions of modern operating systems.
2. To understand the concept of process, thread management and scheduling.
3. To learn the concept of concurrency control.
4. To study various Memory Management techniques.
5. To know the concept of I/O and File management.
6. To learn concept of system software.

#### Course Outcomes:
On completion of the course, students will be able to–

- **CO1:** Explain the role of Modern Operating Systems.
- **CO2:** Apply the concepts of process and thread scheduling.
- **CO3:** Illustrate the concept of process synchronization, mutual exclusion and the deadlock.
- **CO4:** Implement the concepts of various memory management techniques.
- **CO5:** Make use of concept of I/O management and File system.
- **CO6:** Understand Importance of System software.

### COURSE CONTENTS

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<th>Unit I</th>
<th>OVERVIEW OF OPERATING SYSTEM</th>
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<th>Mapping of Course Outcomes for Unit I</th>
<th>CO1</th>
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<tr>
<th>Unit II</th>
<th>PROCESS MANAGEMENT</th>
<th>( 06 hrs )</th>
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</thead>
</table>
| **Process:** Concept of a Process, Process States, Process Description, Process Control  
**Threads:** Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads.  
**Scheduling:** Types of Scheduling, Scheduling Algorithms, First Come First Served, Shortest Job First, Priority, Round Robin. |
<table>
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<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit III</strong></td>
<td><strong>CONCURRENCY CONTROL</strong></td>
</tr>
<tr>
<td><strong>Process/thread Synchronization and Mutual Exclusion:</strong> Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Operating System Support (Semaphores and Mutex).</td>
<td></td>
</tr>
<tr>
<td><strong>Classical synchronization problems:</strong> Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, Shared Memory).</td>
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</tr>
<tr>
<td><strong>Deadlock:</strong> Principles of Deadlock, Deadlock Modeling, and Strategies to deal with deadlock: Prevention, Avoidance, Detection and Recovery. Example: Dining Philosophers Problem / Banker’s Algorithm.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
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<tbody>
<tr>
<td><strong>Unit IV</strong></td>
<td><strong>MEMORY MANAGEMENT</strong></td>
</tr>
<tr>
<td><strong>Memory Management:</strong> Memory Management Requirements, <strong>Memory Partitioning:</strong> Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Page table structure, Segmentation</td>
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<tr>
<td><strong>Virtual Memory:</strong> Background, Demand Paging, Page Replacement (FIFO, LRU, Optimal), Allocation of frames, Thrashing</td>
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<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
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<tbody>
<tr>
<td><strong>Unit V</strong></td>
<td><strong>INPUT/OUTPUT AND FILE MANAGEMENT</strong></td>
</tr>
<tr>
<td><strong>I/O Management and Disk Scheduling:</strong> I/O Devices, Organization of the I/O Function, I/O Buffering, Disk Scheduling (FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK).</td>
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<table>
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<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5</th>
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<tbody>
<tr>
<td><strong>Unit VI</strong></td>
<td><strong>SYSTEMS SOFTWARE AND ITS IMPORTANCE</strong></td>
</tr>
<tr>
<td><strong>Need of System Software, study of various components of system software.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Assemblers:</strong> Elements of Assembly Language Programming, A simple Assembly Scheme and pass structure of Assemblers.</td>
<td></td>
</tr>
<tr>
<td><strong>Introduction to compilers:</strong> Phase structure of Compiler and entire compilation process. Introduction to Macro processors, Macro Definition and call, Macro Expansion Loaders and Linkers. General Loader Scheme, Subroutine Linkages, Relocation and linking Linkages, Relocation and linking</td>
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<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit VI</th>
<th>CO6</th>
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### E-Books / E-Learning References:

1. [https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf](https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf)

NPTEL video lecture link:

1. [https://nptel.ac.in/courses/106/102/106102132/#](https://nptel.ac.in/courses/106/102/106102132/#)
2. [https://nptel.ac.in/courses/106/106/106106144/](https://nptel.ac.in/courses/106/106/106106144/)
# 314443: Machine Learning

## Teaching Scheme:
- Theory (TH): 3hrs/week

## Credit Scheme:
- 03 Credits

## Examination Scheme:
- Mid_Semester: 30 Marks
- End_Semester: 70 Marks

### Prerequisite Courses:
- 1. Basics of Statistics
- 2. Linear Algebra
- 3. Calculus
- 4. Probability

### Companion Course:
- 1. Artificial Intelligence
- 2. Deep Learning

### Course Objectives:
1. To understand the basic concepts of machine learning and apply them for the various problems.
2. To learn various machine learning types and use it for the various machine learning tasks.
3. To optimize the machine learning model and generalize it.

### Course Outcomes:
- On completion of the course, students will be able to:
- **CO1**: Apply basic concepts of machine learning and different types of machine learning algorithms.
- **CO2**: Differentiate various regression techniques and evaluate their performance.
- **CO3**: Compare different types of classification models and their relevant application.
- **CO4**: Illustrate the tree-based and probabilistic machine learning algorithms.
- **CO5**: Identify different unsupervised learning algorithms for the related real-world problems.
- **CO6**: Apply fundamental concepts of ANN.

## COURSE CONTENTS

### Unit I

<table>
<thead>
<tr>
<th>INTRODUCTION TO MACHINE LEARNING</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong>: What is Machine Learning, Definition, Real life applications, Learning Tasks- Descriptive and Predictive Tasks, Types of Learning: Supervised Learning Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning.</td>
<td></td>
</tr>
<tr>
<td><strong>Features</strong>: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality.</td>
<td></td>
</tr>
<tr>
<td><strong>Dataset Preparation</strong>: Training Vs. Testing Dataset, Dataset Validation Techniques – Hold-out, k-fold Cross validation, Leave-One-Out Cross-Validation (LOOCV).</td>
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</tr>
</tbody>
</table>

Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit II</td>
<td>CLASSIFICATION</td>
</tr>
</tbody>
</table>
**Binary Classification:** Linear Classification model, Performance Evaluation- Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure

**Multi-class Classification:** Model, Performance Evaluation Metrics – Per-class Precision and Per-Class Recall, weighted average precision and recall -with example, Handling more than two classes, Multiclass Classification techniques -One vs One, One vs Rest

**Linear Models:** Introduction, Linear Support Vector Machines (SVM) – Introduction, Soft Margin SVM, Introduction to various SVM Kernel to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid.

**Logistic Regression** – Model, Cost Function.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit II</strong></td>
<td>REREGRESSION</td>
</tr>
</tbody>
</table>

**Regression:** Introduction, Univariate Regression – Least-Square Method, Model Representation, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Optimization of Simple Linear Regression with Gradient Descent - Example. Estimating the values of the regression coefficients

**Multivariate Regression:** Model Representation

**Introduction to Polynomial Regression:** Generalization- Overfitting Vs. Underfitting, Bias Vs. Variance.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit III</strong></td>
<td>TREE BASED AND PROBABILISTIC MODELS</td>
</tr>
</tbody>
</table>

**Tree Based Model:** Decision Tree – Concepts and Terminologies, Impurity Measures -Gini Index, Information gain, Entropy, Tree Pruning -ID3/C4.5, Advantages and Limitations

**Probabilistic Models:** Conditional Probability and Bayes Theorem, Naïve Bayes Classifier, Bayesian network for Learning and Inferencing.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit IV</strong></td>
<td>DISTANCE AND RULE BASED MODELS</td>
</tr>
</tbody>
</table>

**Distance Based Models:** Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), Neighbors and Examples, K-Nearest Neighbour for Classification and Regression, Clustering as Learning task: K-means clustering Algorithm-with example, k-medoid algorithm-with example, Hierarchical Clustering, Divisive Dendrogram for hierarchical clustering, Performance Measures

**Association Rule Mining:** Introduction, Rule learning for subgroup discovery, Apriori Algorithm, Performance Measures – Support, Confidence, Lift.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit V</strong></td>
<td>INTRODUCTION TO ARTIFICIAL NEURAL NETWORK</td>
</tr>
</tbody>
</table>
Perceptron Learning – Biological Neuron, Introduction to ANN, McCulloch Pitts Neuron, Perceptron and its Learning Algorithm, Sigmoid Neuron, Activation Functions: Tanh, ReLu

Multi-layer Perceptron Model – Introduction, Learning parameters: Weight and Bias, Loss function: Mean Square Error

Introduction to Deep Learning

Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
</tr>
</thead>
</table>

Text Books:


Reference Books:

5. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014

E-Books / E-Learning References:

1. Introduction to Machine Learning: https://nptel.ac.in/courses/106/106/106106139/
6. Deep Learning: https://onlinecourses.nptel.ac.in/noc19_cs54/preview
7. Naive Bayes from Scratch: https://courses.analyticsvidhya.com/courses/naive-bayes
**Savitribai Phule Pune University, Pune**

**Third Year Information Technology (2019 Course)**

**314444: Human Computer Interaction**

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory (TH) : 3 hrs/week</td>
<td>03 Credits</td>
<td>Mid_Semester : 30 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End_Semester : 70 Marks</td>
</tr>
</tbody>
</table>

**Prerequisite Courses:**
1. Problem Solving and Object Oriented Technologies

**Course Objectives:**
1. To introduce to the field of human-computer-interaction study.
2. To gain an understanding of the human part of human-computer-interactions.
3. To learn to do design and evaluate effective human-computer-interactions.
4. To study HCI models and theories.
5. To understand HCI design processes.
6. To apply HCI to real life use cases.

**Course Outcomes:**
On completion of the course, students will be able to–

**CO1:** Explain importance of HCI study and principles of user-centered design (UCD) approach.

**CO2:** Develop understanding of human factors in HCI design.

**CO3:** Develop understanding of models, paradigms, and context of interactions.

**CO4:** Design effective user-interfaces following a structured and organized UCD process.

**CO5:** Evaluate usability of a user-interface design.

**CO6:** Apply cognitive models for predicting human-computer-interactions.

**COURSE CONTENTS**

<table>
<thead>
<tr>
<th>Unit I</th>
<th>INTRODUCTION</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is HCI?, Disciplines involved in HCI, Why HCI study is important?</strong> The psychology of everyday things Donald A. Norman, Principles of HCI, User-centered Design. Measurable Human factors.</td>
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</tr>
</tbody>
</table>

**Mapping of Course Outcomes for Unit I**

| CO1 |

<table>
<thead>
<tr>
<th>Unit II</th>
<th>UNDERSTANDING THE HUMAN and HUMAN INTERACTION</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping of Course Outcomes for Unit II</td>
<td>CO2</td>
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<tr>
<td>----------------------------------------</td>
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</tr>
<tr>
<td><strong>Unit III</strong></td>
<td><strong>HCI MODELS AND THEORIES</strong></td>
<td>(06 hrs)</td>
</tr>
<tr>
<td><strong>User Profiles</strong>, categorization of users, Goal and task hierarchy model, Linguistic model, Physical and device models, GOMS, Norman’s 7 stage model, Cognitive architectures, Hierarchical task analysis (HTA), Uses of task analysis, Diagrammatic dialog design notations.</td>
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<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
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<tr>
<td><strong>Unit IV</strong></td>
<td><strong>DESIGN PROCESS</strong></td>
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<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO4</th>
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<tbody>
<tr>
<td><strong>Unit V</strong></td>
<td><strong>HCI GUIDELINES AND EVALUATION TECHNIQUES</strong></td>
</tr>
<tr>
<td><strong>Using toolkits</strong>, User interface management system (UIMS), Goals of evaluation, Categorization of Evaluation techniques, Choosing an Evaluation Method. DECIDE, Heuristic Evaluation, cognitive walk through, Usability testing</td>
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</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit VI</strong></td>
<td><strong>FUTURE TRENDS</strong></td>
</tr>
<tr>
<td><strong>Ubiquitous Computing</strong>, Design thinking, Finding things on web, Augmented Reality, Virtual Reality, Challenges in designing interfaces for smart homes, smart devices, handheld devices, smart wrist watch, Future of HCI</td>
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</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit VI</th>
<th>CO6</th>
</tr>
</thead>
</table>

**Text Books:**

2. Ben Shneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs (29 August 2013).
## Reference Books:

5. Alan Cooper (1 January 1999). The Inmates are running the Asylum, Sam’s. ISBN 978-0-672-31649-4.

## E-Books / E-Learning References:

1. http://hcibib.org/
5. www.baddesigns.com
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314445(A) : Elective -I : Design and Analysis of Algorithm

Teaching Scheme: Credit Scheme: Examination Scheme:
Theory (TH) : 3 hrs/week 03 Credits Mid_Semester : 30 Marks

Prerequisite Courses:
1. Data Structures and Algorithms.
2. Discrete Structures.

Course Objectives:
1. To understand the problem solving and problem classification.
2. To know the basics of computational complexity analysis of various algorithms.
3. To provide students with foundations to deal with a variety of computational problems using different design strategies.
4. To select appropriate algorithm design strategies to solve real world problems.
5. To understand the concept of nondeterministic polynomial algorithms.

Course Outcomes:
On completion of the course, students will be able to–

CO1: Calculate computational complexity using asymptotic notations for various algorithms.
CO2: Apply Divide & Conquer as well as Greedy approach to design algorithms.
CO3: Understand and analyze optimization problems using dynamic programming.
CO4: Illustrate different problems using Backtracking.
CO5: Compare different methods of Branch and Bound strategy.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit</th>
<th>INTRODUCTION</th>
<th>(07 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proof Techniques: Contradiction, Mathematical Induction, Direct proofs, Proof by counter example, Proof by contraposition.</td>
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</tr>
<tr>
<td>Analysis of Non-recursive and recursive algorithms: Solving Recurrence Equations using Masters theorem and Substitution method.</td>
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</tbody>
</table>
# Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

## Mapping of Course Outcomes for Unit I

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<tr>
<th>CO1</th>
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</thead>
</table>

## Unit II

### DIVIDE AND CONQUER AND GREEDY METHOD (06 hrs)

**Divide & Conquer:** General method, Quick Sort – Worst, Best and average case. Binary search, Finding Max-Min, Large integer Multiplication (for all above algorithms analysis to be done with recurrence).

**Greedy Method:** General method and characteristics, Kruskal’s method for MST (using nlogn complexity) Dijkstra’s Algorithm, Fractional Knapsack problem, Job Sequencing, Max flow problem and Ford-Fulkerson algorithm in transport network

## Mapping of Course Outcomes for Unit II

<table>
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<th>CO1, CO2</th>
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</thead>
</table>

## Unit III

### DYNAMIC PROGRAMMING (06 hrs)

**General strategy** , Principle of optimality, 0/1 knapsack Problem, Coin change-making problem, Bellman-Ford Algorithm, Multistage Graph problem (using Forward computation), Travelling Salesman Problem

## Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO1, CO3</th>
</tr>
</thead>
</table>

## Unit IV

### BACKTRACKING (06 hrs)

**General method** , Recursive backtracking algorithm, Iterative backtracking method. n-Queen problem, Sum of subsets, Graph coloring, 0/1 Knapsack Problem.

## Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO1, CO4</th>
</tr>
</thead>
</table>

## Unit V

### BRANCH AND BOUND (06 hrs)

**The method** , Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling salesperson problem- LC branch and bound

## Mapping of Course Outcomes for Unit V

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<thead>
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<th>CO1, CO5</th>
</tr>
</thead>
</table>

## Unit VI

### COMPUTATIONAL COMPLEXITY (05 hrs)

**Non Deterministic algorithms** , The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover

## Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO1, CO6</th>
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</table>

## Text Books:

Reference Books:

Course: Elective - I: Advanced Database Management System

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

**Teaching Scheme:**
Theory (TH): 3 hrs/week

**Credit Scheme:**
03 Credits

**Examination Scheme:**
Mid_Semester: 30 Marks
End_Semester: 70 Marks

**Prerequisite Courses:**
1. Database Management System

**Course Objectives:**
1. To understand the fundamental concepts of Relational and Object-oriented databases.
2. To learn and understand various Parallel and Distributed Database Architectures and Applications.
3. To understand and apply the basic concepts, categories and tools of NoSQL Database.
4. To learn and understand Data warehouse and OLAP Architectures and Applications.
5. To learn data mining architecture, algorithms, software tools and applications.
6. To learn enhanced data models for advanced database applications.

**Course Outcomes:**
On completion of the course, students will be able to–
CO1: Differentiate relational and object-oriented databases.
CO2: Illustrate parallel & distributed database architectures.
CO3: Apply concepts of NoSQL Databases.
CO4: Explain concepts of data warehouse and OLAP technologies.
CO5: Apply data mining algorithms and various software tools.
CO6: Comprehend emerging and enhanced data models for advanced applications.

**COURSE CONTENTS**

<table>
<thead>
<tr>
<th>Unit I</th>
<th>REVIEW OF RELATIONAL DATA MODEL AND RELATIONAL DATABASE CONSTRAINTS</th>
<th>(06 hrs)</th>
</tr>
</thead>
</table>

Relational model concepts, Relational model constraints and relational database schemas, Update operations, anomalies, dealing with constraint violations, Types and violations. **Overview of Object-Oriented Concepts** – Objects, Basic properties. Advantages, examples, Abstract data types, Encapsulation, class hierarchies, polymorphism examples.

Mapping of Course Outcomes for Unit I: CO1

<table>
<thead>
<tr>
<th>Unit II</th>
<th>PARALLEL AND DISTRIBUTED DATABASES</th>
<th>(06 hrs)</th>
</tr>
</thead>
</table>

**Introduction to Parallel Databases**, Architectures for parallel databases, Parallel query evaluation, Parallelizing individual operations, Parallel query optimizations. **Introduction to distributed databases**, Distributed DBMS architectures, storing data in a Distributed DBMS, Distributed catalog management, Distributed Query processing, Updating distributed data, Distributed transactions, Distributed Concurrency control and Recovery.
<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit III</strong></td>
<td><strong>NOSQL DATABASES</strong> (06 hrs)</td>
</tr>
<tr>
<td><strong>Introduction, Overview, and History of NoSQL Databases</strong>: The definition of Four Types of No SQL Databases. NoSQL Key/Value Database: MongoDB, <strong>Column-Oriented Database</strong>: Apache Cassandra, Comparison of Relational and NoSQL databases, NoSQL database Development Tools (Map Reduce/Hive) and Programming Languages (XML/JSON)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit IV</strong></td>
<td><strong>DATA WAREHOUSING</strong> (06 hrs)</td>
</tr>
<tr>
<td><strong>Architectures and components of data warehouse</strong>, Characteristics and limitations of data warehouse, Data warehouse schema (Star, Snowflake), OLAP Architecture (ROLAP/MOLAP/HOLAP), Introduction to decision support system, Views and Decision support</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit V</strong></td>
<td><strong>DATA MINING</strong> (06 hrs)</td>
</tr>
<tr>
<td><strong>Introduction to Data Mining</strong>, KDD seven step process, Architecture of data mining, Introduction to predictive and descriptive algorithms, Data mining software and applications</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit VI</strong></td>
<td><strong>ENHANCED DATA MODELS FOR ADVANCED APPLICATIONS</strong> (06 hrs)</td>
</tr>
<tr>
<td><strong>Active database concepts and triggers</strong>: Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit VI</th>
<th>CO6</th>
</tr>
</thead>
</table>

**Text Books:**

**Reference Books:**
2. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining: Concepts and Techniques”, Elsevier
# 314445(C) : Elective - I : Design Thinking

## Teaching Scheme:
- Theory (TH) : 3 hrs/week
- 03 Credits

## Examination Scheme:
- Mid_Semester : 30 Marks
- End_Semester : 70 Marks

### Prerequisite Courses:
1. Software Engineering
2. Problem Solving

### Companion Course:
Human Computer Interaction

### Course Objectives:
1. To learn the Design thinking basic concepts.
2. To identify the opportunities and challenges for design thinking innovation.
3. To describe the define and ideate process of design thinking.
4. To summarize the prototyping techniques.
5. To enlist the activities carried out in Test and reflect phase of design thinking.
6. To Interpret Design Thinking case studies.

### Course Outcomes:
On completion of the course, students will be able to—
- **CO1**: Identify need and features of design thinking.
- **CO2**: Identify the opportunities and challenges for design thinking innovation.
- **CO3**: Learn the process of design thinking using various tools.
- **CO4**: Summarize and learn the various prototyping techniques.
- **CO5**: Enlist the activities carried out in Test and reflect phase of design thinking.
- **CO6**: Interpret the design thinking disruptive innovations through case studies.

## COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit</th>
<th>INTRODUCTION TO DESIGN THINKING</th>
<th>(06 hrs )</th>
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</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit I</th>
<th><strong>CO1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit II</strong></td>
<td><strong>EXPLORE AND EMPATHIZE</strong></td>
</tr>
</tbody>
</table>
**Explore- STEEP Analysis**, Activity Systems, Stakeholder Analysis, Framed Opportunities
Empathise- Observation, Problem statement, User Interviews- Interview for Empathy, Explorative Interview, Ask 5x Why, 5W+H questions (Design Thinking Toolbox), Needs Finding, Empathy Map, Persona Development, Customer Journey Map

### Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>Unit III</th>
<th>DEFINE AND IDEATE</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Define- Define Point of view</strong>, “How might we ...” question, Storytelling, Context Mapping Ideate- Brainstorming, 2x2 Matrix Ideate- Purpose, Methods &amp; Tools, SCAMPER, SCAMPER for Ideation, SCAMPER template, Analogous Inspiration, IDEATION using Deconstruct &amp; Reconstruct, User Experience Journey</td>
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### Mapping of Course Outcomes for Unit III

<table>
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<tr>
<th>Unit IV</th>
<th>PROTOTYPE</th>
<th>(06 hrs )</th>
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### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>Unit V</th>
<th>TEST AND REFLECT</th>
<th>(06 hrs )</th>
</tr>
</thead>
</table>

### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>Unit VI</th>
<th>DISRUPTIVE INNOVATION</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reimagining the Trade Show Experience at IBM, Redesigning the Customer Contact Center at Toyota, Social Networking at MeYou Health, Rethinking Subsidized Meals for the Elderly at The Good Kitchen THE SOCIAL PROBLEM Design Thinking in Healthcare with IDEO, Design Thinking Transformed Airbnb, IBM Design Thinking: A Framework To Help Teams Continuously Understand and Deliver, UberEATS.</strong></td>
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</table>

### Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
<th>Text Books:</th>
</tr>
</thead>
</table>

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*TE (Information Technology) Syllabus (2019 Course)*
Reference Books:


E-Books / E-Learning References:

2. The IBM Story: https://www.coursera.org/lecture/uva-darden-design-thinking-innovation/the-ibm-story-iq0kE
3. Design Thinking - A Primer online course video lectures by IIT Madras (freevideolectures.com)
4. NPTEL: Humanities and Social Sciences - NOC: Understanding Design Thinking & People Centered Design
5. NPTEL: Management - NOC: Design Thinking - A Primer
7. UberEATS: https://medium.com/uber-design/how-we-design-on-the-ubereats-team-ff7c41fffb76
11. https://www.innovationtraining.org/design-thinking-workshop-resources/
## Teaching Scheme:

<table>
<thead>
<tr>
<th>Theory (TH)</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
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<tbody>
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<td>3 hrs/week</td>
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<td>Mid_Semester: 30 Marks</td>
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<td></td>
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<td>End_Semester: 70 Marks</td>
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</tbody>
</table>

### Prerequisite Courses:
1. Basics of Computer Network
2. Processor Architecture

### Course Objectives:
1. To know the IoT fundamentals and understanding the technologies.
2. To learn the concept of M2M (machine to machine) with necessary protocols.
3. To understand the Python Scripting Language and controlling hardware for IoT.
4. To learn the IoT Platforms widely used in IoT applications.
5. To understand the implementation of web-based services on IoT devices with cloud interface.
6. To introduce the IoT applications.

### Course Outcomes:
On completion of the course, students will be able to–

#### CO1: Discuss fundamentals, architecture and framework of IoT.

#### CO2: Select suitable sensors and actuators for real time scenarios.

#### CO3: Justify the significance of protocol for wireless communication and IoT challenges

#### CO4: Understand the Python programming for development of IoT applications.

#### CO5: Understand the cloud interfacing technologies.

#### CO6: Design and Implement real time IoT applications.

## COURSE CONTENTS

### Unit I

**INTRODUCTION TO IOT**


### Mapping of Course Outcomes for Unit I

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### Unit II

**THINGS IN IOT**

### Mapping of Course Outcomes for Unit II

**CO2**

**Unit III**

**COMMUNICATION PROTOCOLS AND IOT CHALLENGES**

*(06 hrs)*

**Introduction to Non-IP Based Protocol** (IEEE 802.11, IEEE 802.15.4), BlueTooth, ZigBee, IP Based Protocol (IPV4, IPV6, 6LoWPAN), Application Layer Protocols (MQTT, AMQP) Wireless medium access issues, MAC protocol, routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

### Mapping of Course Outcomes for Unit III

**CO3**

**Unit IV**

**IOT PLATFORMS AND ITS PROGRAMMING**

*(06 hrs)*

**Introduction to Arduino and Raspberry Pi**– Installation, Interfaces (Serial, SPI, I2C), Introduction to Python program with Raspberry Pi with focus on interfacing external gadgets (Bluetooth Speaker, CCTV Camera, Robotic Arm etc.), controlling output, and reading input from pins. Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

### Mapping of Course Outcomes for Unit IV

**CO4**

**Unit V**

**IOT PHYSICAL SERVERS AND CLOUD OFFERINGS**

*(06 hrs)*

**Introduction to Cloud Storage models** (SaaS, Paas, IaaS) and communication APIs Web server – Web server for IoT, Cloud for IoT (ThingSpeak, Ubidots), Python web application framework, Designing a RESTful web API.  

**IoT Security**: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modelling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non repudiation and availability, Security model for IoT.

### Mapping of Course Outcomes for Unit V

**CO5**

**Unit VI**

**DOMAIN SPECIFIC APPLICATIONS OF IOT**

*(06 hrs)*

**Home Automation** - Smart Appliances, Intrusion Detection, Smoke/Gas Detector, Smart City -Smart Parking, Smart Road, Structural Health Monitoring, Surveillance applications, Health - Fitness and Health Monitoring, Wearable Electronics, Agriculture - Smart Irrigation, Greenhouse Control, Environment - Weather Monitoring, Noise Pollution Monitoring, Logistic - Root Generation and Scheduling, Shipment Monitoring, Retail Management - Inventory Management, Smart Payments, 

**Industry Applications** - Machine Diagnosis and Prognosis, Indoor Air Quality Monitoring.

### Mapping of Course Outcomes for Unit VI

**CO6**

**Text Books:**

Reference Books:


E-Books / E-Learning References:

1. Introduction to Arduino and its Setup: https://www.arduino.cc/en/software
   Overall IoT Course Contents: https://onlinecourses.nptel.ac.in/noc21_cs17/preview
### Teaching Scheme:

<table>
<thead>
<tr>
<th>Practical (PR)</th>
<th>Credit Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 hrs/week</td>
<td>02 Credits</td>
<td>PR: 25 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW: 25 Marks</td>
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### Prerequisites:

1. C Programming
2. Fundamentals of Data Structure

### Course Objectives:

1. To introduce and learn Linux commands required for administration.
2. To learn shell programming concepts and applications.
3. To demonstrate the functioning of OS basic building blocks like processes, threads under the LINUX.
4. To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion), CPU Scheduling, Memory Management and Disk Scheduling in LINUX.
5. To demonstrate the functioning of Inter Process Communication under LINUX.
6. To study the functioning of OS concepts in kernel space like embedding the system call in any LINUX kernel.

### Course Outcomes:

On completion of the course, students will be able to—

**CO1:** Apply the basics of Linux commands.

**CO2:** Build shell scripts for various applications.

**CO3:** Implement basic building blocks like processes, threads under the Linux.

**CO4:** Develop various system programs for the functioning of OS concepts in user space like concurrency control, CPU Scheduling, Memory Management and Disk Scheduling in Linux.

**CO5:** Develop system programs for Inter Process Communication in Linux.

### Guidelines for Instructor's Manual

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

### Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all aspects.
### Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to the theory & implementation of the experiments he/she has carried out.

3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

### Guidelines for Laboratory Conduction

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student’s programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

### List of Laboratory Assignments

#### Group A

**Assignment No. 1:**

A. Study of Basic Linux Commands: echo, Is, read, cat, touch, test, loops, arithmetic comparison, conditional loops, grep, sed etc.

B. Write a program to implement an address book with options given below: a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit

**Assignment No. 2:**

Process control system calls: The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states.

A. Implement the C program in which main program accepts the integers to be sorted. Main program uses the FORK system call to create a new process called a child process. Parent process sorts the integers using sorting algorithm and waits for child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.

B. Implement the C program in which main program accepts an array. Main program uses the FORK system call to create a new process called a child process. Parent process sorts an array and passes the sorted array to child process through the command line arguments of EXECVE system call. The child process uses EXECVE system call to load new program which display array in reverse order.
Assignment No. 3:
Implement the C program for CPU Scheduling Algorithms: Shortest Job First (Preemptive) and Round Robin with different arrival time.

Assignment No. 4:

Assignment No. 5:
Implement the C program for Deadlock Avoidance Algorithm: Bankers Algorithm.

Assignment No. 6:
Implement the C program for Page Replacement Algorithms: FCFS, LRU, and Optimal for frame size as minimum three.

Assignment No. 7:
Inter process communication in Linux using following.
A. **FIFOS**: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process and displays on standard output.

B. **Inter-process Communication using Shared Memory using System V.** Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and writes the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.

Assignment No. 8: Implement the C program for Disk Scheduling Algorithms: SSTF, SCAN, C-Look considering the initial head position moving away from the spindle.

Study Assignment: Implement a new system call in the kernel space, add this new system call in the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.
<table>
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<th>Reference Books:</th>
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### Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

#### 314447: Human Computer Interaction Laboratory

<table>
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<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
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<tbody>
<tr>
<td>Practical (PR): 2 hrs/week</td>
<td>01 Credits</td>
<td>OR: 50 Marks</td>
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</table>

#### Prerequisites:
1. Problem Solving and Object-Oriented Technologies

#### Course Objectives:
1. To study the field of human-computer-interaction.
2. To gain an understanding of the human part of human-computer-interactions.
3. To learn to do design and evaluate effective human-computer-interactions.
4. To study HCI models and theories.
5. To understand HCI design processes.
6. To apply HCI to real life use cases.

#### Course Outcomes:
On completion of the course, students will be able to—

- **CO1**: Differentiate between good design and bad design.
- **CO2**: Analyze creative design in the surrounding.
- **CO3**: Assess design based on feedback and constraint.
- **CO4**: Design paper-based prototypes and use wire frame.
- **CO5**: Implement user-interface design using web technology.
- **CO6**: Evaluate user-interface design using HCI evaluation techniques.

#### Guidelines for Instructor’s Manual
The faculty member should prepare the laboratory manual for all the experiments, and it should be made available to students and laboratory instructor/Assistant.

The instructor’s manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, references.

#### Guidelines for Student’s Lab Journal
1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor’s sign, Theory Concept, printouts of the code written using coding standards, sample test cases etc. To support Go-green, printouts should be asked to any 2 students from each batch. However, all students must submit the soft copy and should be maintained by batch teacher.
2. Oral Examination will be based on the HCI theory and HCI lab term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The Oral examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.

5. All the assignment mentioned in the syllabus must be conducted.

### Guidelines for Lab/TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware such as tags, coding standards, design flow to be implemented etc. should be checked by the concerned faculty member(s).

### Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. All the assignments should be conducted on 64-bit open-source software.

### Guidelines for Oral Examination

Both internal and external examiners should jointly conduct Oral examination. During assessment, the examiners should give the maximum weightage to the satisfactory answer of the problem statement in question. The supplementary and relevant questions may be asked at the time of evaluation to judge the student’s understanding of the fundamentals, effective and efficient implementation.

### List of Laboratory Assignments

**Group A: CO1,2,3**

1. **Identify and observe bad designs**
   Students are expected to submit minimum of 3 to 5 photographs of bad designs in their surrounding or home or any product or neighborhood and create a report mentioning why is it bad? They can submit word/pdf file having photos and description, source of photos and place and mention why is it bad and discuss the outcome during lab session.

2. **"The Jugad"**:
   Humans are very creative and often use it to get work done with available set up and resources. Students are expected to identify Jugad (things used creatively but not meant for that) things and submit minimum of 3 to 5 photographs of jugad in their surrounding or home or neighborhood. Prepare a report mentioning the Jugad and source of photos. Discuss the outcome during lab session.

3. **Feedback and Constraint**:
   Products or interfaces should offer useful feedback to understand the state and have constraints to avoid mistakes while using them. Students are expected to identify and analyze minimum of 5
interfaces or products offering feedback and constraint. Prepare a report clearly showcasing feedback and constraint and support it with minimum of 5 photographs taken in their surrounding or home or neighborhood. Discuss the outcome during lab session.

<table>
<thead>
<tr>
<th>Group B: CO 4,5</th>
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<tr>
<td>4. Prototype and wire frame:</td>
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<tr>
<td>Students are expected to choose a problem statement and identify –</td>
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<tr>
<td>Types of users going to use (age, experience, environmental conditions during use etc..) Minimum 3 scenarios of use Create paper-based prototypes for scenarios.</td>
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<tr>
<td>Use any open-source tool to wire frame scenarios.</td>
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<tr>
<td>5. CSS:</td>
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<tr>
<td>Students are expected to design minimum of 5 web pages using CSS for the problem statement chosen in assignment no. 4. Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page</td>
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<tr>
<th>Group C: CO 5,6</th>
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<tbody>
<tr>
<td>1. CMS tool:</td>
</tr>
<tr>
<td>Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 5 forms. Use WordPress/ Joomla/ Drupal /PHP/ CSS/Bootstrap/ JavaScript.</td>
</tr>
<tr>
<td>2. Evaluation of Interface:</td>
</tr>
<tr>
<td>Students are expected to evaluate minimum of two products / software interface against known HCI evaluation.</td>
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<table>
<thead>
<tr>
<th>Reference Books:</th>
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<tbody>
<tr>
<td>3. <a href="https://www.w3schools.com">https://www.w3schools.com</a></td>
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Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314448 : Laboratory Practice-I (Machine Learning)

<table>
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<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
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<tr>
<td>Practical (PR) : 4 hrs/week</td>
<td>02 Credits</td>
<td>PR : 25 Marks TW: 25 Marks</td>
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Prerequisites:
1. Python programming language

Course Objectives:
1. The objective of this course is to provide students with the fundamental elements of machine learning for classification, regression, clustering.
2. Design and evaluate the performance of a different machine learning models.

Course Outcomes:
On completion of the course, students will be able to–

CO1: Implement different supervised and unsupervised learning algorithms.

Guidelines for Instructor’s Manual
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal
1. Students should submit term work in the form of a handwritten journal based on a specified list of assignments.
2. Practical Examination will be based on the term work.
3. Students are expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab / TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratories should be as a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in a journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student programs should be attached to the journal by every student and the same to be maintained by the department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.
Guidelines for Laboratory Conduction

1. All the assignments should be implemented using python programming language
2. Implement any 4 assignments out of 6
3. Assignment clustering with K-Means is compulsory
4. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic.
5. The instructor may frame multiple sets of assignments and distribute them among batches of students.
6. All the assignments should be conducted on multicore hardware and 64-bit open-sources software

Guidelines for Practical Examination

1. Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.
2. The supplementary and relevant questions may be asked at the time of evaluation to judge the student’s understanding of the fundamentals, effective and efficient implementation.
3. The evaluation should be done by both external and internal examiners.

List of Laboratory Assignments

Group A

1. Data preparation:
   Download heart dataset from following link.
   https://www.kaggle.com/zhaoyingzhu/heartcsv
   Perform following operation on given dataset.
   a) Find Shape of Data
   b) Find Missing Values
   c) Find data type of each column
   d) Finding out Zero's
   e) Find Mean age of patients
   f) Now extract only Age, Sex, ChestPain, RestBP, Chol. Randomly divide dataset in training (75%) and testing (25%).

   Through the diagnosis test I predicted 100 report as COVID positive, but only 45 of those were actually positive. Total 50 people in my sample were actually COVID positive. I have total 500 samples.
   Create confusion matrix based on above data and find
   I. Accuracy
   II. Precision
   III. Recall
   IV. F-1 score

2. Assignment on Regression technique
   Download temperature data from below link. https://www.kaggle.com/venky73/temperatures-of-india?select=temperatures.csv

   This data consists of temperatures of INDIA averaging the temperatures of all places month wise. Temperatures values are recorded in CELSIUS
   a. Apply Linear Regression using suitable library function and predict the Month-wise
temperature.

b. Assess the performance of regression models using MSE, MAE and R-Square metrics

c. Visualize simple regression model.

3. Assignment on Classification technique

Every year many students give the GRE exam to get admission in foreign Universities. The data set contains GRE Scores (out of 340), TOEFL Scores (out of 120), University Rating (out of 5), Statement of Purpose strength (out of 5), Letter of Recommendation strength (out of 5), Undergraduate GPA (out of 10), Research Experience (0=no, 1=yes), Admitted (0=no, 1=yes). Admitted is the target variable.

Data Set Available on kaggle (The last column of the dataset needs to be changed to 0 or 1)

Data Set: https://www.kaggle.com/mohansacharya/graduate-admissions

The counselor of the firm is supposed check whether the student will get an admission or not based on his/her GRE score and Academic Score. So to help the counselor to take appropriate decisions build a machine learning model classifier using Decision tree to predict whether a student will get admission or not.

Apply Data pre-processing (Label Encoding, Data Transformation....) techniques if necessary.

Perform data-preparation (Train-Test Split)

C. Apply Machine Learning Algorithm

D. Evaluate Model.

4. Assignment on Improving Performance of Classifier Models

A SMS unsolicited mail (every now and then known as cell smartphone junk mail) is any junk message brought to a cellular phone as textual content messaging via the Short Message Service (SMS). Use probabilistic approach (Naive Bayes Classifier / Bayesian Network) to implement SMS Spam Filtering system. SMS messages are categorized as SPAM or HAM using features like length of message, word depend, unique keywords etc.

Data Set from : http://archive.ics.uci.edu/ml/datasets/sms+spam+collection

This dataset is composed by just one text file, where each line has the correct class followed by the raw message.

a. Apply Data pre-processing (Label Encoding, Data Transformation....) techniques if necessary

b. Perform data-preparation (Train-Test Split)

c. Apply at least two Machine Learning Algorithms and Evaluate Models

d. Apply Cross-Validation and Evaluate Models and compare performance.

e. Apply Hyper parameter tuning and evaluate models and compare performance.

5. Assignment on Clustering Techniques

Download the following customer dataset from below link:

Data Set: https://www.kaggle.com/shwetabh123/mall-customers

This dataset gives the data of Income and money spent by the customers visiting a Shopping Mall. The data set contains Customer ID, Gender, Age, Annual Income, Spending Score. Therefore, as a mall owner you need to find the group of people who are the profitable customers for the mall owner. Apply at least two clustering algorithms (based on Spending Score) to find the group of customers.

a. Apply Data pre-processing (Label Encoding , Data Transformation....) techniques if necessary.

b. Perform data-preparation(Train-Test Split)
c. Apply Machine Learning Algorithm  
 d. Evaluate Model.  
 e. Apply Cross-Validation and Evaluate Model  

6. Assignment on Association Rule Learning  
Download Market Basket Optimization dataset from below link.  
Data Set: https://www.kaggle.com/hemanthkumar05/market-basket-optimization

This dataset comprises the list of transactions of a retail company over the period of one week. It contains a total of 7501 transaction records where each record consists of the list of items sold in one transaction. Using this record of transactions and items in each transaction, find the association rules between items.  
There is no header in the dataset and the first row contains the first transaction, so mentioned header = None here while loading dataset.  
 a. Follow following steps :  
 b. Data Preprocessing  
 c. Generate the list of transactions from the dataset  
 d. Train Apriori algorithm on the dataset  
 e. Visualize the list of rules  
 f. Generated rules depend on the values of hyper parameters. By increasing the minimum confidence value and find the rules accordingly  

7. Assignment on Multilayer Neural Network Model  
Download the dataset of National Institute of Diabetes and Digestive and Kidney Diseases from below link :  

The dataset is has total 9 attributes where the last attribute is “Class attribute” having values 0 and 1. (1=“Positive for Diabetes”, 0=”Negative”)  
a. Load the dataset in the program. Define the ANN Model with Keras. Define at least two hidden layers. Specify the ReLU function as activation function for the hidden layer and Sigmoid for the output layer.  
b. Compile the model with necessary parameters. Set the number of epochs and batch size and fit the model.  
c. Evaluate the performance of the model for different values of epochs and batch sizes.  
d. Evaluate model performance using different activation functions Visualize the model using ANN Visualizer.

Reference Books:  
8. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014

Virtual Laboratory:

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314448 (A): Laboratory Practice-I (Design and Analysis of Algorithm)

<table>
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<tr>
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<td></td>
<td></td>
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Prerequisites:
1. Data Structures and Algorithms.
2. Discrete Structures.
3. C/C++ programming

Course Objectives:
1. To learn the various algorithmic design strategies.
2. To apply efficiently in problem solving.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Implement the various algorithmic design strategies and use it to solve real time problems/applications
CO2: Apply Divide & Conquer as well as Greedy approach to design algorithms.
CO3: Analyze optimization problems using dynamic programming.

Guidelines for Instructor’s Manual
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student’s Lab Journal
1. Students should submit term work in the form of a handwritten journal based on a specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratories should be a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in a journal may be avoided. There must be handwritten write-ups for every assignment in the journal. The DVD/CD containing student programs
should be attached to the journal by every student and the same to be maintained by the
department/lab In-charge is highly encouraged. For reference one or two journals may be
maintained with program prints at Laboratory.

### Guidelines for Laboratory Conduction

1. The instructor is expected to frame the assignments by understanding the prerequisites,
technological aspects, utility and recent trends related to the topic.
2. The instructor may set multiple sets of assignments and distribute them among batches of
students. It is appreciated if the assignments are based on real world problems/applications.
3. All the assignments should be conducted on multicore hardware and 64-bit open-source
software

### Guidelines for Practical Examination

1. Both internal and external examiners should jointly set problem statements for practical examination.
   During practical assessment, the expert evaluator should give the maximum weightage to the
   satisfactory implementation of the problem statement.
2. The supplementary and relevant questions may be asked at the time of evaluation to judge the
   student’s understanding of the fundamentals, effective and efficient implementation.
   The evaluation should be done by both external and internal examiners.

### List of Laboratory Assignments

1. Write a program to implement Fractional knapsack using Greedy algorithm and 0/1 knapsack using
dynamic programming. Show that Greedy strategy does not necessarily yield an optimal solution over
a dynamic programming approach.
2. Write a program to implement Bellman-Ford Algorithm using Dynamic Programming and verify the
time complexity
3. Write a recursive program to find the solution of placing n queens on the chessboard so that no two
queens attack each other using Backtracking.
4. Write a program to solve the travelling salesman problem and to print the path and the cost using LC
Branch and Bound.

### Reference Books

Savitribai Phule Pune University, Pune  
Third Year Information Technology (2019 Course)  
314448 (B) : Laboratory Practice-I (ADBMS)

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<th>Teaching Scheme:</th>
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| Practical (PR) : 4 hrs/week | 02 Credits | PR : 25 Marks  
TW : 25 Marks |

**Prerequisites:**
1. Database Management System

**Course Objectives:**
1. To learn and understand Database Modeling, Architectures.
2. To learn and understand Advanced Database Programming Frameworks.
3. To learn NoSQL Databases (Open source) such as MongoDB.
4. To design and develop application using NoSQL Database.
5. To design data warehouse schema for given system.

**Course Outcomes:**
On completion of the course, students will be able to

- **CO1:** Apply advanced Database Programming Languages.
- **CO2:** Apply the concepts of NoSQL Databases.
- **CO3:** Install and configure database systems.
- **CO4:** Populate and query a database using MongoDB commands.
- **CO5:** Design data warehouse schema of any one real-time: CASE STUDY
- **CO6:** Develop small application with NoSQL Database for back-end.

**Guidelines for Instructor's Manual**
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

**Guidelines for Student's Lab Journal**
1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.
Guidelines for Lab /TW Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

3. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student’s programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory Conduction

1. Group A assignments are compulsory and should be performed by individual student.

2. Group B case study may be performed in group of 3/4.

3. Mini project of Group C can be implemented using any suitable front-end. But back-end must be MongoDB.

Guidelines for Practical Examination

1. Practical Examination will be based on the all topics covered.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.

List of Laboratory Assignments

Group A : MongoDB

1. Create a database with suitable example using MongoDB and implement
   - Inserting and saving document (batch insert, insert validation)
   - Removing document
     - Updating document (document replacement, using modifiers, up inserts, updating multipledocuments, returning updated documents)
   - Execute at least 10 queries on any suitable MongoDB database that demonstrates following:
     a. Find and find One (specific values)
     b. Query criteria (Query conditionals, OR queries, $not, Conditional semantics) Type-specific queries (Null, Regular expression, Querying arrays)
     c. $ where queries
     d. Cursors (Limit, skip, sort, advanced query options)
2. Implement Map-reduce and aggregation, indexing with suitable example in MongoDB. Demonstrate the following:
   - Aggregation framework
   - Create and drop different types of indexes and explain () to show the advantage of the indexes.
3. Case Study: Design conceptual model using Star and Snowflake schema for any one database.
4. Mini Project

Pre-requisite: Build the mini project based on the requirement document and design prepared as a part of Database Management Lab in second year.
   1. Form teams of around 3 to 4 people.
   2. Develop the application:
      Build a suitable GUI by using forms and placing the controls on it for any application. Proper data entry validations are expected.
      Add the database connection with front end. Implement the basic CRUD operations.
   3. Prepare and submit report to include: Title of the Project, Abstract, List the hardware and software requirements at the backend and at the front end, Source Code, Graphical User Interface, Conclusion.

Reference Books:

3. Jiawei Han, Micheline Kamber, Jian Pei “Data Mining: concepts and techniques”, 2nd Edition, Publisher: Elsevier/Morgan Kaufmann.
## Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

### 314448 (C) : Laboratory Practice-1 (Design Thinking)

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
</table>
| Practical (PR) : 4 hrs/week | 02 Credits | PR : 25 Marks
|                  |              | TW: 25 Marks        |

**Prerequisites:** NA

**Course Objectives:**

1. To identify the opportunities and challenges for design thinking innovation and empathize and ideate for it.
2. To describe the solution by prototyping the design.

**Course Outcomes:**

On completion of the course, students will be able to–

**CO1:** Frame and Design Challenge by performing STEEP Analysis, Conduct Interviews, design and ask 5x Why and 5W+H questions.

**CO2:** Demonstrate the activities to empathize with the users by creation of Empathy Map, Persona Development, Customer Journey Map.

**CO3:** Define and ideate process of design thinking and perform brainstorming, selection of ideas, create a storyboard and design paper prototyping or digital prototyping for chosen design challenge.

### Guidelines for Instructor’s Manual

The faculty member should prepare the laboratory manual for all the experiments, and it should be made available to students and laboratory instructor/Assistant.

### Guidelines for Student’s Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted only if the journal of the candidate is complete in all respects.

### Guidelines for Lab /TW Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of write-ups along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out
3. Appropriate knowledge of usage templates related to respective laboratory should be checked by the concerned faculty member.
Guidelines for Laboratory Conduction

1. Students should be asked to form a group of 3 to 4 students and identify design challenge to provide the solution to real life engineering problems within the social, environmental and economic context.

2. All the assignments should be conducted using the templates provided in the reference books.

3. The faculty member should help student to identify Online free or open source tools like diagrams.net, LucidChart, Draw.io, Creatly, Openboard, Microsoft whiteboard etc. which will help students to collaborate and draw diagram.

4. After every assignment, student group should be asked to demonstrate their design and discuss findings.

Guidelines for Practical Examination

1. Students will be provided with 2 problem statements options covering the detail design challenge statements and student will have to perform any one.

2. All the problem statements carry equal weightage.

List of Laboratory Assignments

Group A- CO1, CO2, CO3

Assignment-I- Inspiration Phase: Perform STEEP analysis by using MAKING SENSE OF STEEP ANALYSIS & STRATEGIC PRIORITIES TEMPLATE and Frame Your Design Challenge. Conduct Interviews, design and ask 5x Why and 5W+H questions

Assignment-II- Empathize Phase: Observe the user and design Empathy Map, Generate persona/User profile and Customer Journey map

Assignment-III- Define and Ideate: Share Stories and learning from research- Cluster Insights into themes, Create Insights statements, create ‘How might we’ questions

Assignment-IV Prototype Phase: Brainstorm, select your ideas, create a storyboard, determine what to prototype, start prototyping, Design Paper Prototype/digital Prototype, test your prototype and get feedback, Create your Action plan, create pitch, share your solution, perform reflection

Reference Books:


2. Mr. Lee Chong Hwa (Lead Facilitator), “The Design Thinking: Guidebook”


### Teaching Scheme:

<table>
<thead>
<tr>
<th>Practical (PR) : 4 hrs/week</th>
<th>Credit Scheme</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>02 Credits</td>
<td>TW: 25 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PR: 25 Marks</td>
</tr>
</tbody>
</table>

**Prerequisites:**
1. Programming Skill Development Lab.

### Course Objectives:

1. To learn interfacing of sensor and actuators using Arduino Uno/Raspberry Pi
2. To learn and understand IoT platforms and its significance for real time applications
3. To learn and understand the steps involved in python programming for IoT applications

### Course Outcomes:

On completion of the course, students will be able to—

- **CO1:** Design and implement real time applications with sensors and actuators.
- **CO2:** Design and develop real time IoT based application by cloud interfacing.

### Guidelines for Instructor’s Manual

Faculty Member should prepare lab manual by taking the review of latest IoT devices with specifications and made it available for students/Lab assistant

### Guidelines for Student’s Lab Journal

1. Student should submit term work after the completion of entire assignment, only.
2. Practical Examination will be fully based on entire assignment set as per the given instructor manual.
3. Student should know the theory involved in the experiment.
4. Student will be eligible for practical examination only after the submission of term work in stipulated time.

### Guidelines for Lab /TW Assessment

1. Instructor/Examiners will assess the student only based on performance of students considering the parameters such as timely submission of assignment, use of proper methodology for implementation of assignment.
2. Student must have appropriate basics and fundamental of software and hardware usage and its relevance with submitted assignment. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal and the same will be submitted for future reference to Lab Instructor.

### Guidelines for Laboratory Conduction

1. All assignments are compulsory and should be performed by individual student.

### Guidelines for Practical Examination

1. Practical Examination will be fully based on entire laboratory assignments.
2. Examiners will judge the students based on practical performed in the examination and by asking some questions related to implementation of experiments, which he/she has carried out.
### Group A

1. Design and implement IoT system using Arduino Uno/ Raspberry Pi using 'Ultrasonic sensor and Servo motor' such as 'Door opener in home automation'.
2. Design and implement parameter monitoring IoT system keeping records on Cloud such as 'environment humidity and temperature monitoring'.
3. Design and implement real time monitoring system using android phone (Blynk App.) such as 'soil parameter monitoring'.
4. Design and implement IoT system for one of the applications like: Traffic Application, Medical/Health application, Social Application etc.

### Text Books:


### Reference Books:


### E-Books / E-Learning References:

1. Introduction to Arduino and its Setup : https://www.arduino.cc/en/software
2. Introduction to Raspberry Pi and its OS (Raspbian Lit) :
3. Introduction to header files and support : https://github.com/
Cloud for IoT - ThingSpeak : https://thingspeak.com/
5. Overall IoT Course Contents: https://onlinecourses.nptel.ac.in/noc21_cs17/preview
# Curriculum for Third Year Information Technology (2019 Course), Savitribai Phule Pune University

## Savitribai Phule Pune University, Pune
### Third Year Information Technology (2019 Course)

#### 314449 : Seminar

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (PR) : 01 hrs/week</td>
<td>01 Credits</td>
<td>TW : 50 Marks</td>
</tr>
</tbody>
</table>

### Prerequisites:
1. Project Based Learning
2. Software Engineering

### Course Objectives:
Seminar should make the student attain skills like:
1. To gather the literature of specific area in a focused manner.
2. To summarize the literature to find state-of-the-art in proposed area.
3. To identify scope for future work.
4. To present the case for the intended work to be done as project.
5. To report literature review and proposed work in scientific way.

### Course Outcomes:
On completion of the course, students will be able to—

**CO1:** Understand, interpret and summarize technical literature.

**CO2:** Demonstrate the techniques used in the paper.

**CO3:** Distinguish the various techniques required to accomplish the task.

**CO4:** Identify intended future work based on the technical review.

**CO5:** Prepare and present the content through various presentation tools and techniques in effective manner.

**CO6:** Keep audience engaged through improved interpersonal skills.

### Guidelines for Seminar Selection and Presentation

1. Student shall identify the area or topics in Information Technology referring to recent trends and developments in consultation with industry (for their requirement) and institute guide.
2. Student must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their topic as decided.
3. Seminar topics should be based on recent trends and developments. Guide should approve the topic by thoughtfully observing different techniques, comparative analysis of the earlier algorithms used or specific tools used by various researchers in the domain.
4. Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE,CSI or from freely available digital libraries like Digital Library of India (dl.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc.
5. Student shall present the study as individual seminars in 20 – 25 minutes in English which is followed by Question Answer session.
6. Guide should ensure that students are doing literature survey and review in proper manner.
7. Guide should give appropriate instructions for effective presentation.
8. Attendance of all other students in the class for presentation is mandatory.
Timeline is suggested to follow throughout the semester:

1) Week– 01: Discussion to understand what is technical paper, how to search, where to search?
2) Week– 02: Download technical papers (minimum four), getting approved from Guide and Prepare abstract summary of all papers downloaded.
3) Week– 03 & 04: Read and understand in detail the decided research papers about the problem statement, techniques used, experimental details and results with conclusion from identified papers.
4) Week– 05: Review of the studied papers by Guide / Panel.
5) Week – 06 & 07: Search / Find equivalent techniques (other than the one proposed in technical paper) so performance / complexities can be improved (by amortized analysis, not actual implementation).
6) Week – 08 & 09: Prepare presentation with outline as The topic, its significance, The research problem, Studied solutions (through research papers) with strengths and weaknesses of each solution, comparison of the solutions to research problem, future directions of work, probable problem statement of project, tentative plan of project work
8) Week – 11: Deliver Presentation to Guide/ Panel.
9) Week–12: Verification of Seminar report and Submission.

Guidelines for Seminar report

1. Each student shall submit two copies of the seminar report in appropriate text editing tool/software as per prescribed format duly signed by the guide and Head of the department/Principal.
2. Broad contents of review report (20-25 pages) shall be
   a) Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution, Year & University.
   b) Seminar Approval Sheet/Certificate.
   c) Abstract and Keywords.
   d) Acknowledgments.
   e) Table of Contents, List of Figures, List of Tables and Nomenclature.
   f) Chapters need to cover topic of discussion-
      i. Introduction with section including organization of the report,
      ii. Literature Survey
      iii. Motivation, purpose and scope and objective of seminar
      iv. Details of design/technology/Analytical and/or experimental work, if any/
      v. Discussions and Conclusions,
      vi. Bibliography/References (in IEEE Format),
      vii. Plagiarism Check report,
3. Students are expected to use open source tools for writing seminar report, citing the references and plagiarism detection.
## Guidelines for Lab /TW Assessment:

1. A panel of reviewers constituted by seminar coordinator (where guide is one of the member of the panel) will assess the seminar during the presentation.
2. Student’s attendance for all seminars is advisable.
3. Rubric for evaluation of seminar activity:
   - **i.** Relevance of topic - 05 Marks
   - **ii.** Relevance + depth of literature reviewed - 10 Marks
   - **iii.** Seminar report (Technical Content) - 10 Marks
   - **iv.** Seminar report (Language) - 05 Marks
   - **v.** Presentation Slides - 05 Marks
   - **vi.** Presentation & Communication Skills - 05 Marks
   - **vii.** Question and Answers - 10 Marks
   
   **TOTAL: 50 Marks**

## Reference Book:


## Text Book:

Savitribai Phule Pune University, Pune  
Third Year Information Technology (2019 Course)  
Mandatory Audit Course 5  
314450 (A): Banking and Insurance  

Teaching Scheme:  
Theory (TH): 1 hrs/week  

Credit Scheme:  
No Credits  

Examination Scheme:  
Audit Course  

Prerequisite Courses: If any  

Course Objectives: -  
1. To understand banking system in India.  
2. To understand negotiable instruments.  
3. To learn attributes of different types of insurance policies.  
4. To create awareness about nature and functioning of annuities.  

Course Outcomes: -  
On completion of the course, students will be able to–  
CO1: Differentiate between types of banks and their working.  
CO2: Carry out banking transactions on their own.  
CO3: Decide which insurance policy they should buy.  
CO4: Handle investing in annuities and claim settlements.  

COURSE CONTENTS  

Unit I  
INTRODUCTION TO BANKING  
( 03 hrs )  

Definition of Bank - Basic functions of Banker  

Mapping of Course Outcomes for Unit I  
CO1  

Unit II  
BANK FUNDS AND INSTRUMENTS  
( 03 hrs )  

Employment of Bank Funds: Liquid Assets-Cash in Hand, Cash with RBI & Cash with other Banks, Investment in securities, Advances - Secured and Unsecured, Loans, Term Loans, Cash Credit, Overdraft, Discounting of Bills of Exchange, Modes of creating charge on Securities, Types of Securities.  

### Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2</th>
<th>INTRODUCTION TO INSURANCE</th>
<th>(03 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept of Insurance, Need for Insurance.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


**Life Insurance:** Present Organizational set-up of Insurance Companies in India – L.I.C. and Private Companies with foreign joint ventures, selling Insurance through Agents and Banks.

Objectives of Life Insurance – Protection and Investment, Different types of Life Insurance Policies – Chief characteristics and similarity. Online vs Offline policies

Basic Pre-requisites for Life Insurance – Insurable Interest and utmost Good Faith.

**Procedure for taking a policy:** (a) Selection of the Plan. (b) Consultation of Premium tables. (c) Filling up of Proposal Form. (d) Document regarding proof of age. (e) Important clauses of the Policy – eg. Suicide Clause. (f) Nomination

### Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
<th>ULIPs AND POLICY MATTERS</th>
<th>(03hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annuities and Unit Linked Policies:</strong> Concept of Annuity, Objectives of Annuity, Procedure followed for obtaining Annuities, Meaning of Unit Linked Insurance Policies, Procedure for obtaining Unit linked insurance Policies.</td>
<td></td>
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</tr>
</tbody>
</table>

**General Insurance:** General Insurance companies, types of general insurance

**Post - Issue Matters:** Lapse of the Policy due to Non-Payment of Premium, Revival of the Lapsed Policies, Surrender of the Policy – Payment of surrender value, Assignment of the Policies, Settlement of claims – Procedure to be followed.

### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
</tr>
</thead>
</table>

**Text Books:**

2. D.D. Chaturvedi, Arun Mittal, Saumya Chaturvedi, Banking and Insurance, Scholar Tech Press, ASIN : B08S3H36K1

**E-Books / E-Learning References:**

1. https://onlinecourses.swayam2.ac.in/cec21_ge04/preview
# Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

## Mandatory Audit Course 5
### 314450 (B): Startup Ecosystems

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory (TH): 1 hrs/week</td>
<td>No Credits</td>
<td>Audit Course</td>
</tr>
</tbody>
</table>

**Prerequisite Courses:** NA

**Course Objectives:**
To familiarize students:
1. New venture creation opportunities, its resources, and requirements for Enterprise Startup
2. Legal requirements for new ventures
3. Financial issues and strategies related to startups

**Course Outcomes:**
- completion of the course, students will be able to—
  - CO1: Identify Startup opportunities
  - CO2: Explain legal and other requirements for new ventures
  - CO3: Analyze financial issues of startups

## COURSE CONTENTS

### Unit I

<table>
<thead>
<tr>
<th>STARTUP OPPORTUNITIES</th>
<th>(04 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current industrial revolution, Idea Generation with brainstorming, Business Startup, ideation, choices of venture, the rise of Startup economy, forces of change, startup equation, the entrepreneurial ecosystem, Indian government initiatives, Entrepreneurship in India, Case Study: MEITY Startup Hub</td>
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</tbody>
</table>

**Mapping of Course Outcomes for Unit I**

<table>
<thead>
<tr>
<th>CO1</th>
</tr>
</thead>
</table>

### Unit II

<table>
<thead>
<tr>
<th>STARTUP ECOSYSTEM</th>
<th>(04 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Startups ecosystem: Support organizations, big companies, universities, funding organizations, service providers, research organizations, Startup development phases: Ideating, conception, committing, validating, scaling, establishing, Startup business partnering, Startup culture, Co-founders, FFF (Fools, friends and family), Angels</td>
<td></td>
</tr>
</tbody>
</table>

**Mapping of Course Outcomes for Unit II**

<table>
<thead>
<tr>
<th>CO2</th>
</tr>
</thead>
</table>

### Unit III

<table>
<thead>
<tr>
<th>STARTUP CAPITAL REQUIREMENTS AND LEGAL ENVIRONMENT</th>
<th>(04 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of capital resource requirements of startup, estimating startup finance requirements, deciding a process map, Positioning the venture in the value chain – Framing risk reduction strategy, Startup financing metrics, Legal perspectives- New Ventures approval procedures- Taxes or duties payable for new ventures, Case Study: Technology Incubation and Development of Entrepreneurs (TIDE)</td>
<td></td>
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</tbody>
</table>

**Mapping of Course Outcomes for Unit III**

<table>
<thead>
<tr>
<th>CO3</th>
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</table>
### Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
</tr>
</thead>
</table>

#### Text Books:

#### Reference Books:
2. Vijay Sathe, Corporate Entrepreneurship, 1e, Cambride, 2009.
Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

Mandatory Audit Course 5
314450 (C): Foreign Language - (Japanese Language-III)

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory (TH) :1 hrs/week</td>
<td>Non Credit</td>
<td>Audit Course</td>
</tr>
</tbody>
</table>

Prerequisite Courses, if any:
1. Students must have already studied can read/write Hiragana and Katakana script
2. Students must have studied Japanese for beginners that includes the syllabus of Audit course Module 1 and 2

Course Objectives:
To familiarize students with-
1. Japan Market needs: To meet the needs of ever growing industry with respect to the Japanese language support.
2. Japanese Culture and Mindset: To get introduced to Japanese society and culture through language.
3. Career opportunities: To know more about Higher studies, Career opportunities in Japan / Japanese companies across the world.
4. Soft skills and self-development: To learn the manners, business culture and develop the confidence by gaining the knowledge of global perspective and cross-cultural studies.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Do basic communication.
CO2: Demonstrate knowledge of Japanese script (reading, writing and listening skills).
CO3: Demonstrate knowledge about Japanese culture, life style, manners and etiquettes.
CO4: Pursue professional Japanese Language course.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>JAPANESE-BEGINNERS LEVEL</th>
<th>(3 hrs Lecture + 3 hrs Self-study)</th>
</tr>
</thead>
</table>


Reference:
- a. Revision of beginner level studied in Module1-2
- b. Nihongo Challenge Kanji - Lesson 1
# Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

## Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
<th>JAPANESE SCRIPT</th>
</tr>
</thead>
</table>

## Introduction to Demonstrative pronouns
- (ko-so-a-do)
- Asking/requesting for something
- Making sentences using various question words
- Stating/asking age, nationality, profession
- Culture/Others: Information about Japanese standardized test (JLPT, NAT etc.), Kanjis: 11 to 20, Listening practice
- Vocabulary and conversation practice.

**Reference:**
- a. Minna no Nihongo I: Lesson 1 and 2 (Text book + Audio and Video)
- b. Nihongo Challenge Kanji - Lesson 2

## Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2</th>
<th>BASIC JAPANESE GRAMMAR</th>
<th>(3 hrs Lecture + 3 hrs Self-study)</th>
</tr>
</thead>
</table>

## Unit II

**Basic Japanese Grammar**
- Conversation at the shop, asking price, location, Telling time and scheduling tasks
- Introduction to Verb groups (root, present, past, negative)
- Culture/Others: Conversation and Behavior at the shop, How to buy train tickets, Train manners, Introduction to social issues and Japanese society, Kanjis: 21 to 30, Listening practice
- Vocabulary and conversation practice.

**Reference:**
- a. Minna no Nihongo I: Lesson 3 and 4 (Text book + Audio and Video)
- b. Nihongo Challenge Kanji - Lesson 3

## Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
<th>JAPANESE FOR DAILY COMMUNICATION</th>
<th>(3 hrs Lecture + 3 hrs Self-study)</th>
</tr>
</thead>
</table>

## Unit III

**Japanese for Daily Communication**
- Directions and heading towards (use of particle de, he and relevant vocabulary)
- Actions (use of particle wo and relevant vocabulary)
- Types of adjectives (root, negative, past, past negative)
- Culture/Others: Party, gifts related conversation, Gifting culture in Japan, Introduction to Japanese economy and market needs, Kanjis: 31 to 40, Listening practice
- Vocabulary and conversation practice.

**Reference:**
- a. Minna no Nihongo I: Lesson 5 and 6 (Text book + Audio and Video)
- b. Nihongo Challenge Kanji - Lesson 4
### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
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</table>

<table>
<thead>
<tr>
<th>Text Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Minna no Nihongo I</strong> – Main Text book with audio and video files (Books by Goyal Publishers - Available in shops / Online)</td>
</tr>
<tr>
<td>2. <strong>Minna no Nihongo</strong> - Translation and grammatical notes for self-study (Books by Goyal Publishers - Available in shops / Online)</td>
</tr>
<tr>
<td>3. <strong>Nihongo Challenge – Kanji</strong> (Available with Japanese Language schools/teachers)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Nihongo Shoho</strong>: For better understanding and practice of Basic Japanese Grammar</td>
</tr>
<tr>
<td>2. <strong>Marugoto</strong>: For scenario based Japanese conversation practice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E-Books / E-Learning References:</th>
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</thead>
<tbody>
<tr>
<td>1. <strong>nihongo ichiban</strong></td>
</tr>
<tr>
<td>a. <a href="https://nihongoichiban.com/home/jlpt-n5-study-material/">https://nihongoichiban.com/home/jlpt-n5-study-material/</a></td>
</tr>
<tr>
<td>2. <strong>jlpt sensei</strong></td>
</tr>
<tr>
<td>a. <a href="https://jlptsensei.com/how-to-pass-jlpt-n5-study-guide/">https://jlptsensei.com/how-to-pass-jlpt-n5-study-guide/</a></td>
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</tbody>
</table>
SEMESTER – VI
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314451: Computer Network and Security

<table>
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<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
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<tbody>
<tr>
<td>Theory (TH) : 3 hrs/week</td>
<td>03 Credit</td>
<td>Mid_Semester : 30 Marks</td>
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<tr>
<td></td>
<td></td>
<td>End_Semester : 70 Marks</td>
</tr>
</tbody>
</table>

Prerequisite Courses:
1. Basics of Computer Network

Companion Course:
1. Cyber Security

Course Objectives:
To familiarize students with-
1. The application layer services, responsibilities and protocol.
2. Fathom wireless network and different wireless standards
3. Differences in different wireless networks and to learn different mechanism used at layers of wireless network.
4. The concept of network security.
5. Basic cryptographic techniques in application development.
6. Cyber security vulnerabilities & study typical threats to modern digital systems.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Explain Responsibilities, services offered and protocol used at application layer of network
CO2: Apply concepts of wireless network and different wireless standards.
CO3: Recognize the Adhoc Network’s MAC layer, routing protocol and Sensor network architecture. CO4: Implement the principal concepts of network security and Understand network security threats, security services, and countermeasures
CO5: Apply basic cryptographic techniques in application development.
CO6: Gain a good comprehension of the landscape of cyber security Vulnerabilities & describe typical threats to modern digital systems.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>APPLICATION LAYER</th>
<th>(06 hrs)</th>
</tr>
</thead>
</table>

Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, Application Layer Protocols: DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, DHCP, TELNET.
### Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
<th>WIRELESS STANDARDS</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Wireless LANs:</strong> Fundamentals of WLAN, Design goals, Characteristics, Network Architecture, IEEE 802.11 components in IEEE 802.11 network, Physical Layer, <strong>MAC Sub Layers:</strong> DCF, PCF, Hidden and exposed station problem, Frame format, Addressing Mechanism, IEEE 802.15.1 <strong>Bluetooth:</strong> Architecture Layers, operational states, <strong>IEEE 802.16 WiMax:</strong> Services, Architecture, Layers, comparison between Bluetooth IEEE 802.11 and IEEE 802.16.</td>
<td></td>
</tr>
</tbody>
</table>

### Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2</th>
<th>ADHOC AND WSN</th>
<th>(06 hrs)</th>
</tr>
</thead>
</table>

### Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
<th>INTRODUCTION TO NETWORK SECURITY</th>
<th>(06 hrs)</th>
</tr>
</thead>
</table>

### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
<th>CRYPTOGRAPHIC ALGORITHM</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Mathematical preliminaries:</strong> Groups, Rings, Fields, Prime numbers, Symmetric key algorithms: Data Encryption Standards, Advanced Encryption Standard, <strong>Public Key Encryption and Hash function:</strong> RSA Digital signatures, Digital Certificates and Public Key Infrastructure: Private Key Management, Diffie Hellman key exchange, The PKIX Model</td>
<td></td>
</tr>
</tbody>
</table>
### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>COS</th>
<th>Mapping of Course Outcomes for Unit V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INTRODUCTION TO CYBER SECURITY</td>
</tr>
<tr>
<td></td>
<td>(06 hrs)</td>
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<tr>
<td>CO5</td>
<td></td>
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</tbody>
</table>


### Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Text Books:</td>
</tr>
<tr>
<td></td>
<td>3. Atul Kahate Cryptography and Network Security, 3e, McGraw Hill Education,</td>
</tr>
</tbody>
</table>

### Reference Books:


### E-Books / E-Learning References:

1. [https://nptel.ac.in/courses/106/105/106105160/](https://nptel.ac.in/courses/106/105/106105160/)
2. [https://nptel.ac.in/courses/106/105/106105031/](https://nptel.ac.in/courses/106/105/106105031/)
3. An Introduction to Cyber Security A Beginner’s Guide
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314452: Data Science and Big Data Analytics

Teaching Scheme: Credit Scheme: Examination Scheme:
Theory (TH) :03 Hrs/week 03 Credit Mid_Semester : 30 Marks

Prerequisites:
1. Engineering and discrete mathematics.
2. Database Management Systems, Data warehousing and Data mining.
3. Programming skill.

Companion Course:
1. Machine Learning
2. Advance Database Management

Course Objectives:
1. To introduce basic need of Big Data and Data science to handle huge amount of data.
2. To understand the basic mathematics behind the Big data.
3. To understand the different Big data processing technologies.
4. To understand and apply the Analytical concept of Big data using Python.
5. To visualize the Big Data using different tools.
6. To understand the application and impact of Big Data.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Understand Big Data primitives.
CO2: Learn and apply different mathematical models for Big Data.
CO3: Demonstrate Big Data learning skills by developing industry or research applications.
CO4: Analyze and apply each learning model comes from a different algorithmic approach and it will perform differently under different datasets.
CO5: Understand, apply and analyze needs, challenges and techniques for big data visualization.
CO6: Learn different programming platforms for big data analytics.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>INTRODUCTION: DATA SCIENCE AND BIG DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( 06 Hrs )</td>
</tr>
</tbody>
</table>

Introduction to Data science and Big Data, Defining Data science and Big Data, Big Data examples, Data Explosion: Data Volume, Data Variety, Data Velocity and Veracity. Big data infrastructure and challenges. Big Data Processing Architectures: Data Warehouse, Re-Engineering the Data Warehouse, shared everything and shared nothing architecture, Big data learning approaches. Data Science – The Big Picture: Relation between AI, Statistical Learning, Machine Learning, Data Mining and Big Data Analytics.
### Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
<th>MATHEMATICAL FOUNDATION OF BIG DATA</th>
<th>(07 Hrs)</th>
</tr>
</thead>
</table>

**Probability:** Random Variables and Joint Probability, Conditional Probability and concept of Markov chains, Tail bounds, Markov chains and random walks, Pair-wise independence and universal hashing Approximate counting, Approximate median. **Data Streaming Models and Statistical Methods:** Flajolet Martin algorithm, Distance Sampling and Random Projections, Bloom filters, Mode, Variance, standard deviation, Correlation analysis and Analysis of Variance.

### Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2</th>
<th>BIG DATA PROCESSING</th>
<th>(06 Hrs)</th>
</tr>
</thead>
</table>

**Big Data Analytics- Ecosystem and Technologies,** Introduction to Google file system, Hadoop Architecture, **Hadoop Storage:** HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration, Introduction to NOSQL, Textual ETL processing.

### Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
<th>BIG DATA ANALYTICS</th>
<th>(06 Hrs)</th>
</tr>
</thead>
</table>

**Big Data Analytics- Architecture and Life Cycle,** Types of analysis, Analytical approaches, Data Analytics with Mathematical manipulations, Data Ingestion from different sources (CSV, JSON, html, Excel, mongoDB, mysql, sqlite), Data cleaning, Handling missing values, data imputation, Data transformation, Data Standardization, handling categorical data with 2 and more categories, statistical and graphical analysis methods, Hive Data Analytics.

### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
<th>BIG DATA VISUALIZATION</th>
<th>(06 Hrs)</th>
</tr>
</thead>
</table>

**Introduction to Data visualization,** Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Propriety Data Visualization tools, Open – source data visualization tools, **Case Study:** Analysis of a business problem of Zomato using visualization, Analytical techniques used in Big data visualization, Data Visualization using Tableau Introduction to: Candela, D3.js, Google Chart API.
# Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

## Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>COS</th>
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<tbody>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>

## Unit VI

**BIG DATA TECHNOLOGIES APPLICATION AND IMPACT**

(05 Hrs)

- Social media analytics, Text mining, Mobile analytics, Data analytics life cycle of case studies, Organizational impact, understanding decision theory, creating big data strategy, big data value creation drivers, Michael Porter’s valuation creation models, Big data user experience ramifications, Identifying big data use cases, Big Data Analytics Challenges and Research directions.

## Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
</tr>
</thead>
</table>

## Text Books:


## Reference Books:

2. Dana Ron, Algorithmic and Analysis Techniques in Property Testing, School of EE.
7. EMC Education Services, Data Science and Big Data Analytics- Discovering, analyzing Visualizing and Presenting Data.
10. EMC Education services, Data Science and Big Data Analytics, EMC2 Wiley, ISBN :978812655653-
12. EMC Education Services, Data Science and Big Data Analytics, Wiley India, ISBN:9788126556533
<table>
<thead>
<tr>
<th>E Books / E Learning References</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Link for dataset: <a href="https://www.kaggle.com/tanmoyie/us-graduate-schools-admission-parameters">https://www.kaggle.com/tanmoyie/us-graduate-schools-admission-parameters</a></td>
</tr>
</tbody>
</table>
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314453: Web Application Development

Teaching Scheme:  Credit Scheme:  Examination Scheme:
Theory (TH) : 3 hrs/week  03 Credit  Mid_Semester : 30 Marks

Prerequisite Courses:
1. Programming languages C++, Java.

Companion Course:
1. Advanced Database Management system
2. Design Thinking

Course Objectives: -
1. To familiarize students with Web Programming basic concepts
2. To learn and understand Web scripting languages.
3. To explore the Front end & Backend web programming skills.
4. To understand and learn Mobile web development.
5. To understand and learn Web application deployment.

Course Outcomes: -
On completion of the course, students will be able to–
CO1: Develop Static and Dynamic website using technologies like HTML, CSS, Bootstrap.
CO2: Demonstrate the use of web scripting languages.
CO3: Develop web application with Front End & Back End Technologies.
CO4: Develop mobile website using JQuery Mobile.
CO5: Deploy web application on cloud using AWS.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>INTRODUCTION TO WEB TECHNOLOGIES</th>
<th>( 06 hrs )</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTML:</td>
<td>Getting started with HTML, Why</td>
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<tr>
<td></td>
<td>HTML, Tags and Elements,</td>
<td></td>
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<tr>
<td></td>
<td>Attributes, Properties,</td>
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<tr>
<td></td>
<td>Headings list, Links,</td>
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<tr>
<td></td>
<td>Tables, Images, HTML Form,</td>
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</tr>
<tr>
<td></td>
<td>Media (Audio, Video), Semantic</td>
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<tr>
<td></td>
<td>HTML5 Elements.</td>
<td></td>
</tr>
<tr>
<td>CSS:</td>
<td>Why CSS, Types of CSS, How to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>use CSS, Properties, Classes,</td>
<td></td>
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<tr>
<td></td>
<td>Child-Class (Nested CSS), Colors,</td>
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<td></td>
<td>Text, Background, Border, Margin,</td>
<td></td>
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<tr>
<td></td>
<td>Padding, Positioning (flex, grid,</td>
<td></td>
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<tr>
<td></td>
<td>inline, block), Animation,</td>
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</tr>
<tr>
<td></td>
<td>Transition.</td>
<td></td>
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<tr>
<td>BOOTSTRAP:</td>
<td>Why Bootstrap, CSS over</td>
<td></td>
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<tr>
<td></td>
<td>Bootstrap, How to Use Bootstrap,</td>
<td></td>
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<tr>
<td></td>
<td>Bootstrap Grid System, Bootstrap</td>
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<tr>
<td></td>
<td>Responsive, Bootstrap Classes,</td>
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<td></td>
<td>Bootstrap Components (i.e., Button,</td>
<td></td>
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<tr>
<td></td>
<td>Table, List, etc.), Bootstrap</td>
<td></td>
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<td></td>
<td>as a Cross Platform.</td>
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</tr>
<tr>
<td>W3C:</td>
<td>What is W3C, How W3C handles/</td>
<td></td>
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<tr>
<td></td>
<td>Supports Web Technologies.</td>
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</tbody>
</table>
### Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit I</th>
<th>CO1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WEB SCRIPTING LANGUAGES</strong></td>
<td>(06 hrs)</td>
</tr>
<tr>
<td><strong>JavaScript:</strong> Introduction to Scripting languages, Introduction to JavaScript (JS), JS Variables and Constants, JS Variable Scopes, JS Data Types, JS Functions, JS Array, JS Object, JS Events.</td>
<td></td>
</tr>
<tr>
<td><strong>Advanced JavaScript:</strong> JSON - JSON Create, Key-Value Pair, JSON Access, JSON Array, JS Arrow Functions, JS Callback Functions, JS Promises, JS Async-Await Functions, JS Error Handling.</td>
<td></td>
</tr>
<tr>
<td><strong>AJAX:</strong> Why AJAX, Call HTTP Methods Using AJAX, Data Sending, Data Receiving, AJAX Error Handling.</td>
<td></td>
</tr>
<tr>
<td><strong>JQUERY :</strong> Why Jquery, How to Use, DOM Manipulation with JQuery, Dynamic Content Change with JQuery, UI Design Using JQuery.</td>
<td></td>
</tr>
</tbody>
</table>

### Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRONT END TECHNOLOGIES</strong></td>
<td>(06 hrs)</td>
</tr>
<tr>
<td><strong>Front-End Frameworks:</strong> What is web framework? Why Web Framework? Web Framework Types.</td>
<td></td>
</tr>
<tr>
<td><strong>MVC:</strong> What is MVC, MVC Architecture, MVC in Practical, MVC in Web Frameworks.</td>
<td></td>
</tr>
<tr>
<td><strong>TypeScript:</strong> Introduction to TypeScript (TS), Variables and Constants, Modules in TS.</td>
<td></td>
</tr>
<tr>
<td><strong>AngularVersion 10+:</strong> Angular CLI, Angular Architecture, Angular Project Structure, Angular Lifecycle, Angular Modules, Angular Components, Angular Data Binding, Directives and Pipes, Angular Services and Dependency Injections (DI), Angular Routers, Angular Forms.</td>
<td></td>
</tr>
<tr>
<td><strong>ReactJS:</strong> Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook useContext() hook.</td>
<td></td>
</tr>
</tbody>
</table>

### Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes For Unit III</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BACK END TECHNOLOGIES</strong></td>
<td>(06 hrs)</td>
</tr>
<tr>
<td><strong>ExpressJS:</strong> Introduction to ExpressJS, Configure Routes, Template Engines, ExpressJS as Middleware, Serving Static Files, REST HTTP Method APIs, Applying Basic HTTP Authentication, Implement Session Authentication.</td>
<td></td>
</tr>
<tr>
<td><strong>MongoDB:</strong> NoSQL and MongoDB Basics, MongoDB-Node.JS Communication, CRUD Operations using Node.JS, Mongoose ODM for Middleware, Advanced MongoDB.</td>
<td></td>
</tr>
</tbody>
</table>
## Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO3</th>
<th>MOBILE WEB DEVELOPMENT</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobile-First:</strong></td>
<td>What is Mobile-First? What is Mobile Web? Understanding Mobile Devices and Desktop.</td>
<td></td>
</tr>
<tr>
<td><strong>JQuery Mobile:</strong></td>
<td>Introduction to the jQuery Mobile Framework, Set-up jQuery Mobile, Pages, Icons, Transitions, Layouts Widgets, Events, Forms, Themes, Formatting Lists, Header and Footer, CSS Classes, Data Attributes, Building a Simple Mobile Webpage.</td>
<td></td>
</tr>
</tbody>
</table>

## Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO4</th>
<th>WEB APPLICATION DEPLOYMENT</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cloud:</strong></td>
<td>AWS Cloud, AWS Elastic Compute, AWS Elastic Load Balancer and its types, AWS VPC and Component of VPC, AWS storage, Deploy Website or Web Application on AWS, Launch an Application with AWS Elastic Beanstalk.</td>
<td></td>
</tr>
</tbody>
</table>

## Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO5</th>
<th>Text Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text Books:</strong></td>
<td></td>
</tr>
</tbody>
</table>

## Reference Books:

8. Java Script, D.Flanagan, O'Reilly, SPD.
9. Programming Typescript: Making Your JavaScript Applications Scale, Boris Cherny
### E-Books / E-Learning References:

2. https://www.meanacademy.in/web-technologies
3. https://www.meanacademy.in/angular
4. https://www.meanacademy.in/mongodb
5. https://www.meanacademy.in/nodejs
6. https://www.meanacademy.in/aws
7. https://www.w3schools.com/Css
Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
</table>
| Theory (TH): 3 hrs/week | 03 Credit | Mid_Semester: 30 Marks
|                  |                | End_Semester: 70 Marks |

**Prerequisite Courses:**

**Companion Course:**
1. Lab Practice - II

**Course Objectives:**
1. To understand Fundamental concepts of Artificial Intelligence and different search strategies.
2. To explore Various knowledge representations and reasoning schemes.
3. To understand Fundamentals of NLP and Game Theory.
4. To explore of AI applications.

**Course Outcomes:**
On completion of the course, students will be able to –
- CO1: Apply the fundamental concepts of Artificial Intelligence
- CO2: Choose appropriate search strategies for any AI problem
- CO3: Illustrate knowledge reasoning and knowledge representation methods (for solving real world problems)
- CO4: Analyze the suitable techniques of NLP to develop AI applications
- CO5: Correlate the appropriate methods of Game Theory to design AI applications
- CO6: Understand the concept of deep learning and AI applications

**COURSE CONTENTS**

<table>
<thead>
<tr>
<th>Unit I</th>
<th>INTRODUCTION TO AI And SEARCH</th>
<th>(06 hrs)</th>
</tr>
</thead>
</table>

**Artificial Intelligence:** Introduction, Components of Artificial Intelligence, Characteristics of Artificial Intelligence Systems, Intelligent Agents, Types of Intelligent Agents

**Statistical Analysis:** Correlation coefficient, Rank Correlation, Residual Error, Mean Square Error, RMSE, Probability Distributions, Concept of Discrete PD and Continuous PD

**Search Strategies:** Problem spaces (states, goals and operators), problem solving by search, Uninformed search (breadth-first, depth-first, depth first with iterative deepening)
### Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
<th>PROBLEM SOLVING</th>
<th>(06 hrs)</th>
</tr>
</thead>
</table>
| **Heuristic Search Techniques:** Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best-first Search; Problem Reduction.  
**Constraint Satisfaction problem:** Interference in CSPs; Backtracking search for CSPs; Local Search for CSPs; structure of CSP Problem.  
**Beyond Classical Search:** Local search algorithms and optimization problem, local search in continuous spaces, searching with nondeterministic action and partial observation, online search agent and unknown environments. |
### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
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</table>

### Unit V

**INTRODUCTION TO GAME THEORY** (06 hrs)

**Game Playing:** Overview and Examples.


### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO5</th>
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</table>

### Unit VI

**RECENT AND FUTURE TRENDS IN AI** (06 hrs)


**Applications:** Overview of Artificial Intelligence Domains, AI-Robotics, AI-Neural Networks, AI-IOT, Computer Vision in AI

**Case Studies:** Automatic Bird Identification using Deep Learning, Tumkur monitoring using Computer Vision, Text to Speech Conversion using APIs

### Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

### Text Books:


### Reference Books:

1. Algorithmic Game theory Edited by N Nishan, T Roughgarden; Cambridge University Press
3. Game Theory - D Fudenberg& J Tirole; MIT Press

### E-Books / E-Learning References

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314454 (B): Elective-II (Cyber Security)

Teaching Scheme: 3 hrs/week
Credit Scheme: 03 Credit
Examination Scheme:
Mid_Semester: 30 Marks
End_Semester: 70 Marks

Prerequisite Courses: if Any

Companion Course:
1. Computer Networks & Security

Course Objectives:
1. To learn fundamental concepts of cyber security
2. To learn different types of threats and cyber-crimes.
3. To understand the basics cyber forensics, network forensics, Email forensics, web forensics and crypto currency forensics.
4. To understand the basic digital forensics concepts and techniques for conducting the forensic examination on different digital devices.
5. To analyze how particular social engineering attacks take advantage of specific features of the Internet and of human nature.
6. To learn the IT laws and cyber-crime basics.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Develop basic understanding of cyber security.
CO2: Differentiate among different types of cyber threats and cyber-crimes.
CO3: Illustrate cyber forensic techniques to identify the criminal activities.
CO4: Apply forensic analysis tools to recover important evidence for identifying computercrime
CO5: Distinguish and classify the forms of cybercriminal activity and the technological and social engineering’ methods used to undertake such crimes
CO6: Evaluate the effectiveness of cyber-security, cyber-laws and other countermeasures against cybercrime

COURSE CONTENTS

Unit I
INTRODUCTION TO CYBER SECURITY (06 hrs.)

Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
<th>Cyber Crimes and Hacking (06 hrs)</th>
</tr>
</thead>
</table>

### Overview of Cyber-Attacks and Vulnerabilities,


**Types of Cyber Crime** - cyber stalking, forgery, software piracy, cyber terrorism, phishing, computer vandalism, computer hacking, creating and distributing viruses over internet, spamming, cross site scripting, online auction fraud, cyber-squatting, logic bombs, web jacking, internet time thefts, DoS attack, salami attack, data diddling, email spoofing.

**Types of Hacker** Hacking and Cracking, Hacking: Ethical issues, Ethical Hacking.

Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2</th>
<th>Cyber Forensics (06 hrs)</th>
</tr>
</thead>
</table>

**Introduction to Cyber Forensics:** What are cyber forensics, cyber forensics investigation process, digital evidence, challenges in cyber forensics;

**Web Attack Forensics:** Intrusion forensics, database forensics, preventive forensics; Anti-forensics practices, Anti-forensics detection techniques, Network forensics analysis tools; **Malware Forensics:** Malware types, Malware Analysis, Tools for analysis;

**Email Forensics:** e-mail Protocols, e-mail crimes, email forensics; **Bitcoin Forensics:** crypto currency, crimes related to bitcoin;

**Case Study:** A detailed case study on cyber forensics and its Investigation Reports.

Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
<th>Digital Forensics (06 hrs)</th>
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</table>

**Introduction to Digital Forensics,** Cyber Forensics vs Digital Forensics, the role of digital forensics and its environment, Forensic Software and Hardware, properties of digital evidence, recovering and preserving digital evidence, Advanced forensic Tools, selecting and analyzing digital evidence, validating the evidence, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis

**Case Study:** A detailed case study on Digital Forensics.

Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO3, CO4</th>
<th>Social Engineering (06 hrs)</th>
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</table>


**Case Study:** Phishing and Identity Theft Online Scams
### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>Unit VI</th>
<th>CYBER ETHICS AND LAWS</th>
<th>(06 hrs.)</th>
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### Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text Books:</strong></td>
</tr>
</tbody>
</table>

| **Reference Books:** |

| **E- Books / E- Learning References:** |
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314454 (C): Elective-II- (Cloud Computing)

Teaching Scheme:  Theory (TH) : 3 hrs/week
Credit Scheme:  03 Credit
Examination Scheme:  Mid_Semester : 30 Marks
                              End_Semester : 70 Marks

Prerequisite Courses:
1. Basics of Computer Networks
2. Operating Systems

Course Objectives:
1. To provide students with the fundamentals and essentials of cloud computing
2. To learn basics of virtualization and its importance
3. To provide students a sound foundation of the cloud computing so that they are able to start using and adopting cloud computing services and tools in their real life scenarios
4. To enable students exploring some important cloud computing driven commercial systems and applications
5. To understand cloud storage technologies and relevant file systems
6. To be exposed to Ubiquitous Cloud and Internet of Things

Course Outcomes:
On completion of the course, students will be able to–

CO1: Articulate the main concepts, key technologies and fundamentals of cloud computing.

CO2: Understand cloud enabling technologies and virtualization.

CO3: Analyze various cloud programming models and apply them to solve problems on the cloud.

CO4: Explain data storage and major security issues in the cloud.

CO5: Understand trends in ubiquitous cloud and internet of things.

CO6: Explore future trends of cloud computing.

COURSE CONTENTS

Unit I  FUNDAMENTALS Of CLOUD COMPUTING  (06 hrs)

Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit I</th>
<th>CO1</th>
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<tbody>
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</table>

Unit II  CLOUD-ENABLING TECHNOLOGY AND VIRTUALIZATION  (06 hrs)


Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>Unit III</th>
<th>COMMON STANDARDS AND CLOUD PLATFORMS</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon web services: Compute services Storage Services Communication Services Additional services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google AppEngine: Architecture and core concepts, Application life cycle, Cost model</td>
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</tr>
<tr>
<td>Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance</td>
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</table>

Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>Unit IV</th>
<th>DATA STORAGE AND SECURITY IN CLOUD</th>
<th>(06 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB Gautam Shrauf, Cloud Storage-Overview, Cloud Storage Providers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.</td>
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</tbody>
</table>

Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>Unit V</th>
<th>UBIQUITOUS CLOUDS AND THE INTERNET OF THINGS</th>
<th>(06 hrs)</th>
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</table>

Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>Unit VI</th>
<th>FUTURE OF CLOUD COMPUTING</th>
<th>(06 hrs)</th>
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</table>
### Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>Course Outcomes (CO6)</th>
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</thead>
</table>

### Text Books:


### Reference Books:

Teaching Scheme: 3 hrs/week  03 Credit  Mid_Semester : 30 Marks  
End_Semester : 70 Marks

Prerequisite Courses:
1. Basic Knowledge of Object-oriented Programming
2. Software Engineering
3. Database Management System

Course Objectives:
1. To understand and use of UML to arrive at a design solution for real world problems.
2. To understand basics of object-oriented Modeling.
3. To learn Design concepts to Model for real world problems using object modeling.
4. To explore Interaction and behavior modeling.
5. To understand Software design principles and patterns.
6. To explore the architectural design guidelines in various type of application development.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Understand basics of object oriented methodologies and Unified Modeling Language (UML).
CO2: Apply analysis process, use case modeling, domain/class modeling
CO3: Design and apply interaction and behavior modeling on a given system.
CO4: Comprehend OO design process and business, access and view layer class design.
CO5: Recognize the software design principles and patterns to be applied on system.
CO6: Illustrate architectural design principles and guidelines in the various type of application development.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>INTRODUCTION TO OOM AND UML</th>
<th>( 06 hrs )</th>
</tr>
</thead>
</table>

Introduction to Object Oriented Methodology - Study of various design methodologies like Object Oriented Design by Booch, Object Modelling Techniques by Rumbaugh, Object-Oriented Analysis by Codd Yourdon and Object-Oriented Software Engineering by Ivar Jacobson

Unified Approach – Unification of Booch, Rumbaugh and Jacobson methodologies, Object - Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modelling based on UML, Layered Approach

Unified Modeling Language – Introduction to Modeling and UML2.0, MDA, UML2.0 Structure, UML Building Blocks, UML common Mechanisms, Introduction to all UML2.0 Diagram notational Techniques, 4+1View
<table>
<thead>
<tr>
<th>Mapping of Course</th>
<th>CO1</th>
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<tbody>
<tr>
<td>Outcomes for Unit I</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Unit II</th>
<th>OBJECT ORIENTED ANALYSIS</th>
<th>(06 hrs)</th>
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</table>

**Object Oriented Analysis Process:** Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Case Identification, Uses/Include/Extend Association, Writing a formal use case, Forward Engineering (Use case realization)

**Class Modeling:** Approach for identifying class, Approaches for identifying classes, Class pattern approach, Class Responsibilities, Collaboration Approach, Naming Classes, Class associations Generalization specialization relationship, Aggregation and Composition Relationships

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
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<tbody>
<tr>
<td>Unit III</td>
<td>INTERACTION AND BEHAVIOR MODELING</td>
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</table>

**Activity Diagram:** Activity and Actions, Activity Edge, Decision and Merge Points, Fork-Join, Control Flow, Constraints on Action, Swim Lanes.

**Sequence Diagram:** Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, delete object, Modelling Interactions.

**Collaboration Diagram:** Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram.

**State Diagram:** State Machine, Triggers and Ports, Transitions and conditions, Initial and Final State, nestedstate, Composite States, Submachine States.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
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<tbody>
<tr>
<td>Unit IV</td>
<td>OBJECT ORIENTED DESIGN PROCESS</td>
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</table>


**Designing Access Layer:** Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table — Inherited Classes Mapping, Designing the Access Layer Classes: create mirror classes, identify access layer class relationships, eliminate redundant classes, create method classes.

**Designing View Layer:** View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process – identify view layer objects, and build prototype for view layer Interface.

**Test Usability and User satisfaction:** Component and Deployment Design using Component and Deployment Diagram.
### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
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<tbody>
<tr>
<td><strong>SOFTWARE DESIGN PRINCIPLES AND PATTERNS</strong></td>
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<td><strong>(06 hrs)</strong></td>
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**Introduction to GOF design patterns:** Types of design patterns: Creational Pattern: Singleton, Factory

**Structural Pattern:** Adapter, Façade Behavioral Patterns: Strategy, State

### Mapping of Course Outcomes for Unit V

<table>
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<tr>
<th>CO5</th>
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<tbody>
<tr>
<td><strong>SOFTWARE ARCHITECTURAL DESIGN</strong></td>
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<td><strong>(06 hrs)</strong></td>
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</table>

**Unit V:**

- Anatomy of Software Architecture, Quality attributes in architecture design, Designing Object-Oriented Software Architecture, Designing Client/Server Software Architecture, Designing Service-Oriented Architectures, Designing Component-Based Software Architectures, Designing Concurrent and Real-Time Software Architectures. Product Line Architecture design

### Text Books:


### Reference Books:

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314455: Internship

<table>
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<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
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<tbody>
<tr>
<td>Theory (TH) : 4 hrs/week</td>
<td>04 Credit</td>
<td>Team work: 100 Marks</td>
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</table>

Prerequisite Courses: if Any

Course Objectives:
- To encourage and provide opportunities for students to get professional/personal experience through internships.
- To learn and apply the technical knowledge gained from academics /classroom learning in real life/industrial situations.
- To get familiar with various tools and technologies used in industries and their applications.
- To enable students to develop professional skills and expand their professional network with the development of employer-valued skills like teamwork, communication.
- To apply the experience gained from industrial internship to the academic course completion project.
- To nurture professional and societal ethics in students
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations

Course Outcomes:
On completion of the internship, learner will be able to –
CO1: Develop professional competence through industry internship.
CO2: Apply academic knowledge in a personal and professional environment
CO3: Build the professional network and expose students to future employees.
CO4: Apply professional and societal ethics in their day-to-day life.
CO5: Become a responsible professional having social, economic and administrative considerations.
CO6: Make own career goals and personal aspirations.

Guidelines:
Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/ experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply theoretical knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.
Duration:

Internship to be completed after semester 5 and before commencement of semester 6 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 6.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt./NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO’s/Government organizations/Micro/Small/ Medium enterprises to makethemselves ready for the industry.

Contacting various companies for Internship and Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their Vth semester examination.

Student can take internship work in the form of Online/onsite work from any of the following but not limited to:

- Working for consultancy/ research project,
- Participation at Events (Technical / Business)/in innovation related completions like Hackathon,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Participation in IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT’s, Research organizations,
- NGOs or Social Internships, rural internship,
- Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed after every day by the supervisor/ in charge of the section where the student has been working.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information
Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor /faculty or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Recommended evaluation parameters-Post Internship Internal Evaluation -50 Marks +Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills Communication & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work
After completion of Internship, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/Faculty/TPO for assigning special topics and problems and should prepare the final report on the student’s presence physically, if the student is found absent without prior intimation to the department/institute/concern authority/T & P Cell, entire training can be cancelled.

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / personal observations
- Index/Table of Contents
- Introduction
  - Title/Problem statement/objectives
  - Motivation/Scope and rationale of the study
  - Methodological details
  - Results / Analysis /inferences and conclusion
  - Suggestions / Recommendations for improvement to industry, if any
- Attendance Record
- Acknowledgement
- List of reference (Library books, magazines and other sources)

**Feedback from internship supervisor(External and Internal)**

Post internship, faculty/faculty coordinator should collect feedback about student with following recommended parameters-

- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership.
### Prerequisites:
1. Fundamentals of Computer Networks.

### Course Objectives:
1. To design and implement small size network and to understand various networking commands.
2. To learn various client/server environments to use application layer protocols.
3. To understand network layer routing protocols and its implementations.
4. To understand the network security by using public key cryptography algorithms.

### Course Outcomes:
On completion of the course, students will be able to–

**CO1:** Design and configure small size network and associated networking commands.

**CO2:** Understand various client/server environments to use application layer protocols.

**CO3:** Use basic cryptographic techniques in software and system design.

**CO4:** Apply methods for authentication, access control, intrusion detection.

### Guidelines for Instructor’s Manual
1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/assistant.

### Guidelines for Student’s Lab Journal
1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respect.

### Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.
## Guidelines for Laboratory Conduction

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student’s programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

## List of Laboratory Assignments

### Group A: Computer Network

1. **Using a Network Simulator (e.g. packet tracer) Configure Router for...**
   - b) Configure Access Control lists – Standard & Extended.
   - c) Network Address Translation: Static, Dynamic & PAT (Port Address Translation)

2. **Using a Network Simulator (e.g. packet tracer) Configure Routing Protocols,**
   - c) WLAN with static IP addressing and DHCP with MAC security and filters.

3. **Socket Programming in C/C++ on Linux.**
   - a) TCP Client, TCP Server
   - b) UDP Client, UDP Server

4. **Introduction to server administration** (server administration commands and their applications) and configuration of below Server: (Study/Demonstration Only)
   - a) FTP  
   - b) Web Server

### Group B: Network Security

1. Implement a client and a server on different computers using python. Perform the communication between these two entities by using RSA cryptosystem.

2. Implement a client and a server on different computers using python. Perform the authentication of sender between these two entities by using RSA digital signature cryptosystem.

3. Implement a client and a server on different computers using python. Perform the encryption of message of sender between these two entities by using DES Algorithm and use Diffie Hellman method for exchange of keys.

4. Use the snort intrusion detection package to analyze traffic and create a signature to identify problem traffic.

## Reference Books:

Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314457: DS & BDA Lab

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<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
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<tbody>
<tr>
<td>Practical (PR) : 2 hrs/week</td>
<td>01 Credit</td>
<td>PR : 25 Marks TW: 25 Marks</td>
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</table>

**Prerequisites:**
1. Discrete mathematics
2. Database Management Systems, Data warehousing, Data mining
3. Programming in Python

**Course Objectives:**
1. To understand Big data primitives and fundamentals.
2. To understand the different Big data processing techniques.
3. To understand and apply the Analytical concept of Big data using Python.
4. To understand different data visualization techniques for Big Data.
5. To understand the application and impact of Big Data.
6. To understand emerging trends in Big data analytics.

**Course Outcomes:**
On completion of the course, students will be able to–

CO1: Apply Big data primitives and fundamentals for application development.

CO2: Explore different Big data processing techniques with use cases.

CO3: Apply the Analytical concept of Big data using Python.

CO4: Visualize the Big Data using Tableau.

CO5: Design algorithms and techniques for Big data analytics.

CO6: Design and develop Big data analytic application for emerging trends.

**Guidelines for Instructor’s Manual**
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

**Guidelines for Student’s Lab Journal**
Student should submit term work in the form of handwritten journal based on specified list of assignments.

Practical Examination will be based on the term work.

Candidate is expected to know the theory involved in the experiment.

The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.
Guidelines for Lab /TW Assessment

Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.

Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

Guidelines for Laboratory Conduction

1. All assignments of Part-A, Part-B and first assignment of Part-C should be covered in Laboratory and part of SPPU Practical examination.
2. Part-C second assignments are a group activity to be carried out in group of 4-5 students and students should submit the document related to it as part of journal.

Guidelines for Practical Examination

1. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement.
2. Student ‘s understanding of the fundamentals, effective and efficient implementation can be evaluated by asking relevant questions based implementation of experiments he/she has carried out.

List of Laboratory Assignments

Group A: Assignments based on the Hadoop

1. Single node/Multiple node Hadoop Installation.
2. Design a distributed application using MapReduce(Using Java) which processes a log file of a system. List out the users who have logged for maximum period on the system. Use simple log file from the Internet and process it using a pseudo distribution mode on Hadoop platform.
3. Write an application using HiveQL for flight information system which will include
   a. Creating, Dropping, and altering Database tables.
   b. Creating an external Hive table.
   c. Load table with data, insert new values and field in the table, Join tables with Hive
   d. Create index on Flight Information Table
   e. Find the average departure delay per day in 2008.
Group B: Assignments based on Data Analytics using Python

1. Perform the following operations using Python on the Facebook metrics data sets
   a. Create data subsets
   b. Merge Data
   c. Sort Data
   d. Transposing Data
   e. Shape and reshape Data
2. Perform the following operations using Python on the Air quality and Heart Diseases data sets
   a. Data cleaning
   b. Data integration
   c. Data transformation
   d. Error correcting
   e. Data model building
3. Integrate Python and Hadoop and perform the following operations on forest fire dataset
   a. Data analysis using the Map Reduce in PyHadoop
   b. Data mining in Hive
4. Visualize the data using Python libraries matplotlib, seaborn by plotting the graphs for assignment no. 2 and 3 (Group B)
5. Perform the following data visualization operations using Tableau on Adult and Iris datasets.
   a. 1D (Linear) Data visualization
   b. 2D (Planar) Data Visualization
   c. 3D (Volumetric) Data Visualization
   d. Temporal Data Visualization
   e. Multidimensional Data Visualization
   f. Tree/ Hierarchical Data visualization
   g. Network Data visualization

Group C: Model Implementation

1. Create a review scraper for any ecommerce website to fetch real time comments, reviews, ratings, comment tags, customer name using Python.
2. Develop a mini project in a group using different predictive models techniques to solve any real life problem. (Refer link dataset- https://www.kaggle.com/tanmoyie/us-graduate-schools-admission-parameters)

Reference Books:

2. Data Analytics with Hadoop, Jenny Kim, Benjamin Bengfort, OReilly Media, Inc.
5. Alex Holmes, Hadoop in practice, Dreamtech press.
6. Online References for data set
   - https://www.kaggle.com
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314458: Laboratory Practice-II (Web Application Development)

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
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<tbody>
<tr>
<td>Practical (PR) : 4 hrs/week</td>
<td>02 Credit</td>
<td>PR : 25 Marks</td>
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<td>TW : 50 Marks</td>
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Prerequisites: Programming languages C++, Java

Course Objectives:

1. To understand basic concepts of web programming and scripting languages.
2. To learn Version Control Environment.
3. To learn front end technologies and back end technologies.
4. To understand mobile web development.
5. To comprehend web application deployment.

Course Outcomes:

On completion of the course, students will be able to—

CO1: Develop Static and Dynamic responsive website using technologies HTML, CSS, Bootstrap and AJAX.

CO2: Create Version Control Environment.

CO3: Develop an application using front end and back end technologies.

CO4: Develop mobile website using Jquery Mobile.

CO5: Deploy web application on cloud using AWS.

Guidelines for Instructor’s Manual

Lab Assignments: Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for their respective courses at their level. Beyond curriculum assignments, the mini-project is also included as a part of laboratory work. The inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable).

Guidelines for Student’s Lab Journal

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing student programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journals may be avoided. Submission of journal/term work in the form of softcopy is desirable and appreciated.
Guidelines for Lab/TW Assessment

Term work is continuous assessment that evaluates a student’s progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. It is recommended to conduct an internal monthly practical examination as part of continuous assessment.

Guidelines for Laboratory Conduction

Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for respective courses at their level. Beyond curriculum assignments and mini-project may be included as a part of laboratory work. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. The inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellects within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorials may be as per guidelines of authority.

Guidelines for Practical Examination

Students’ work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.

List of Laboratory Assignments

<table>
<thead>
<tr>
<th>Group A-(WAD)</th>
</tr>
</thead>
</table>

**Assignment 1**

a. Create a responsive web page which shows the ecommerce/college/exam admin dashboard with sidebar and statistics in cards using HTML, CSS and Bootstrap.

b. Write a JavaScript Program to get the user registration data and push to array/local storage with AJAX POST method and data list in new page.
**Assignment 2**

a. Create version control account on GitHub and using Git commands to create repository and push your code to GitHub.
b. Create Docker Container Environment (NVIDEIA Docker or any other).
c. Create an Angular application which will do following actions: Register User, Login User, Show User Data on Profile Component

**Assignment 3**

a. Create a Node.JS Application which serves a static website.
b. Create four API using Node.JS, ExpressJS and MongoDB for CURD Operations on assignment 2.C.

**Assignment 4**

a. Create a simple Mobile Website using jQuery Mobile.
b. Deploy/Host Your web application on AWS VPC or AWS Elastic Beanstalk. Mini Project

Develop a web application using full stack development technologies in any of the following domains:

1. Social Media
2. ecommerce
3. Restaurant
4. Medical
5. Finance
6. Education
7. Any other

**Reference Books:**


**- Books / E- Learning References**

1. https://www.meanacademy.in/web-technologies
2. https://www.meanacademy.in/angular
3. https://www.meanacademy.in/mongodb
4. https://www.meanacademy.in/nodejs
5. https://www.meanacademy.in/aws
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

314458 : Lab Practice – II (Artificial Intelligence )

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (PR) : 4 hrs/week</td>
<td>02 Credit</td>
<td>PR : 25 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW : 50 Marks</td>
</tr>
</tbody>
</table>

Prerequisites: Programming knowledge (Python)

Course Objectives:

1. To develop real world problem solving ability
2. To enable the student to apply AI techniques in applications which involve perception, reasoning and planning
3. To work in team to build industry compliant AI applications

Course Outcomes:

On completion of the course, students will be able to—

CO1: Evaluate and apply core knowledge of AI on various real world problems.
CO2: Illustrate and demonstrate AI tools for different dynamic applications.

Guidelines for Instructor’s Manual

Lab Assignments: Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for their respective courses at their level. Beyond curriculum assignments, the mini-project is also included as a part of laboratory work. The inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable).

Guidelines for Student’s Lab Journal

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing student’s programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journals may be avoided. Submission of journal/term work in the form of softcopy is desirable and appreciated.

Guidelines for Lab /TW Assessment

Term work is continuous assessment that evaluates a student’s progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. It is recommended to conduct an internal monthly practical examination as part of continuous assessment.
Guidelines for Laboratory Conduction

Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for respective courses at their level. Beyond curriculum assignments and mini-project may be included as a part of laboratory work. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. The inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable).

Guidelines for Practical Examination

Students’ work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.

List of Laboratory Assignments

Group A

1. Identify and Implement heuristic and search strategy for Travelling Salesperson Problem
2. Implement n-queens problem using Hill-climbing / simulated annealing / A* algorithm etc.
   Write a program for Water jug problem / Towers of Hanoi
3. Write a program for sorting algorithms using appropriate knowledge representation and reasoning techniques.
4. Write a program for the Information Retrieval System using appropriate NLP tools (such as NLTK, Open NLP, ...)
   a. Text tokenization
   b. Count word frequency
   c. Remove stop words
   d. POS tagging
5. Write a program for the Tic-Tac-Toe game.

Group B (Mini Project)

Develop a Web Based Application for any one of the following:

1. Develop a Text Classification tool as a CRM task or Web Crawler application.
2. Develop a Speech to Text System with the help of POS tagging
3. E-commerce stores using Forward/backward chaining
4. Sudoku puzzle
5. Detection and recognition of object such as Face, Fruit, Finger print etc. using Deep Learning
### Reference Books:

1. Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward Loper
2. [https://www.deeplearningbook.org/contents/TOC.html](https://www.deeplearningbook.org/contents/TOC.html)
3. [https://www.nltk.org/](https://www.nltk.org/)
Savitribai Phule Pune University, Pune  
Third Year Information Technology (2019 Course)  
314458: Lab Practice – II (Cyber Security)

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (PR) : 04 hrs/week</td>
<td>02 Credit</td>
<td>PR : 25 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW : 50 Marks</td>
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</tbody>
</table>

**Prerequisites:** Computer network and security

**Course Objectives:**
1. To develop and understand the placement of packet-sniffer in networking and internetworking environment.
2. To implement the cyber-attacks.
3. To implement intrusion detection and basic mail spamming.

**Course Outcomes:**

On completion of the course, students will be able to—

**CO1:** To know the different guidelines for Packet Sniffing in networking and internetworking environment.

**CO2:** To know the different types of cyber-attacks and will be able to analyze the attacks.

**CO3:** Apply the knowledge of IDS to secure network and performing analysis of IDS attack on network.

**Guidelines for Instructor’s Manual**

The faculty member should prepare the laboratory manual for all the experiments, and it should be made available to students and laboratory instructor/Assistant. The instructor’s manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, references. Experiments to be conducted in Python/any open source language.

**Guidelines for Student’s Lab Journal**

1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept, printouts of the code written using coding standards, sample test cases etc. To support Go-green, printouts on paper are discouraged and should be maintained in soft copy. However, all students must submit the soft copy and should be maintained by batch teacher.

2. Practical Examination will be based on the CS theory and CS lab Assignments.

3. Candidate is expected to know the theory involved in the experiment.

4. The Practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.

5. All the assignment mentioned in the syllabus must be conducted.
**Guidelines for Lab /TW Assessment**

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.

3. Appropriate knowledge of usage of software and hardware such as tags, coding standards, design flow to be implemented etc. should be checked by the concerned faculty member(s).

**Guidelines for Laboratory Conduction**

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. All the assignments should be conducted on open-source software.

**Guidelines for Practical Examination**

Both internal and external examiners should jointly conduct practical examination. During assessment, the examiners should give the maximum weight age to the satisfactory answer of the problem statement in question. The supplementary and relevant questions may be asked at the time of evaluation to judge the student’s understanding of the fundamentals, effective and efficient implementation.

**List of Laboratory Assignments**

1. Write a program to sniff packet sent over the local network and analyze it.

2. Create an attack using python script and implement attack and analyze the effect of attack.
   - a) DDOS Attack
   - b) IP spoofing
   - c) DNS Attack

3. Write a program in python script for Spam Mail Detection (Spam Filtering Implementation).

4. IDS Use Distributed IDS Attack Information to gathers log files from users around the network and prepares reports to determine if their networks have encountered intrusion attempts.

**Reference Books:**


### Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

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**Savitribai Phule Pune University, Pune**  
Third Year Information Technology (2019 Course)  
**314458: Laboratory Practice-II (Cloud Computing)**

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<thead>
<tr>
<th>Teaching Scheme:</th>
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<tbody>
<tr>
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<td>04 hrs/week</td>
<td>PR :25 Marks</td>
</tr>
<tr>
<td></td>
<td>02 Credit</td>
<td>TW : 50Marks</td>
</tr>
</tbody>
</table>

**Prerequisite Courses:**
- Basics of Computer Networks
- Operating Systems

**Course Objectives:**
1. To develop web applications in cloud.
2. To learn the design and development process involved in creating a cloud based application.

**Course Outcomes:**
On completion of the course, students will be able to–

- **CO1:** To design and develop cloud-based applications.
- **CO2:** To Simulate a cloud scenario using CloudSim.
- **CO3:** To design and deploy web applications in cloud environment.

**LIST OF ASSIGNMENTS**

1. Install Google App Engine. Create hello world app and other simple web applications using python/java.
2. Use GAE launcher to launch the web applications.
3. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
6. Design and deploy a web application in a PaaS environment.
7. Design and develop custom Application (Mini Project) using Salesforce Cloud.
8. Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.

**CASE STUDIES**

- Data storage security in private cloud
- Application of IoT/Ubiquitous based on cloud
- Tools for building private cloud

**Text Books:**

**Reference Books:**

### 314458 : Laboratory Practice-II (Software Modeling Design)

<table>
<thead>
<tr>
<th>Teaching Scheme: Hrs</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (PR) : 04 hrs/week</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>TW : 50 Marks</td>
</tr>
</tbody>
</table>

**Prerequisites:**
2. Software Engineering and Project Management.

**Course Objectives:**
1. To teach the student Unified Modeling Language (UML 2.0)
2. To teach the student how to identify different software artifacts at analysis and design phase.
3. To explore and analyze use case modeling.
4. To explore and analyze domain/ class modeling.
5. To develop a system with design and modeling concepts.

**Course Outcomes:**
On completion of the course, students will be able to–

CO1: Develop use case model with the help of UML notations.
CO2: Develop and implement analysis model and design model.
CO3: Develop and implement Interaction and behavior Model.

**Guidelines for Instructor's Manual**
Students should work in group of 3-4 students. Student should identify Project title of enough complexity, which has at least 4-5 major functionalities.

**Guidelines for Student's Lab Journal**
1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical / Oral examination should be conducted if and only if the journal of the candidate is complete in all respects.

**Guidelines for Lab / TW Assessment**
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with diagrams specified in the assignment, implementation (wherever applicable) attendance etc.
2. Examiners will judge the understanding of the practical/ oral performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware should be checked by the concerned faculty member(s).
### Guidelines for Laboratory Conduction

1. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic.
2. The instructor may set multiple sets of assignments and distribute among batches of students. Students should work in groups of 3-4 students. Common problem statement (minimum 3-4 major functionalities it should cover) should be considered to execute all assignment.
3. It is appreciated if the assignments are based on real world problems/applications.
4. Any open-source UML designing tool like StarUML, Visual Paradigm, Umbrello, AgroUML, can be used to draw UML diagram. Languages and databases: JAVA, MySQL, MongoDB, C#.

### Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical/Oral examination. During practical/Oral assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student’s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

### List of Laboratory Assignments

**Assignment 1: Write Problem Statement and draw Use Case diagrams for Mini Project (4 Hrs)**
- Identify Project of enough complexity, which has at least 4-5 major functionalities.
- Identify stakeholders, actors and write detail problem statement for your system.
- Identify Major Use Cases, Identify actors. Write formal Use Case specification for all major Use Cases.

**Assignment 2: Prepare Dynamic Model for the system (4 Hrs)**
- Identify Activity states and Action states.
- Draw Activity diagram with Swim lanes and fork-joins using UML 2.0 Notations for major Use Cases.
- Draw Sequence Diagram Using UML 2.0 notations for major Use Cases.

**Assignment 3: Prepare Static Model for the System (6 Hrs)**
- Draw class diagram using UML 2.0 notations.
- Prepare Data Dictionary for the databases. Draw Deployment diagram UML 2.0 notations.

**Assignment 4: Outputs and Code demonstration (10 Hrs)**
- Write the code for the Mini Project.
- Execute the code and record the output screens.

### Reference Books:

1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011
**Course Objectives:**
1. To know the importance of the energy and the basic infrastructures for the economic development of the country.
2. To know about the most important renewable energy resources and the technologies for harnessing these resources within the framework of a broad range of simple to state-of-the-art energy systems.
3. To understand the application of non-conventional energy technologies.

**Course Outcomes:**
On completion of the course, students will be able to—

- **CO1:** List and explain the main sources of energy and their primary applications in India, and the world.
- **CO2:** Describe the challenges and problems associated with the use of various energy sources and its conservation.
- **CO3:** List and describe the primary renewable energy resources and technologies.
- **CO4:** Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

**COURSE CONTENTS**

<table>
<thead>
<tr>
<th>Unit I</th>
<th>INTRODUCTION TO GREEN AND UNCONVENTIONAL ENERGY STUDIES</th>
<th>(04 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various Non-Conventional energy sources, Need, Availability, Classification, Relative merits &amp; demerits, Global energy scenario, Indian energy scenario, Energy Storage, Distribution and Conservation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mapping of Course Outcomes for Unit I</td>
<td>CO1, CO2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit II</th>
<th>SOLAR and WIND ENERGY</th>
<th>(04 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar energy: Introduction, Conservation of Solar energy</td>
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</tr>
<tr>
<td>Applications: Solar Energy - solar water heater- Solar Cooker-Box type- Solar dryer-solar green house—Summer and winter greenhouse-solar electric power generation-Solar photovoltaic</td>
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</tbody>
</table>
Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2, CO3</th>
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</table>

Unit III

<table>
<thead>
<tr>
<th>BIOMASS ENERGY, GEO THERMAL &amp; TIDAL ENERGY.</th>
<th>(04 hrs)</th>
</tr>
</thead>
</table>

**Biomass Energy:** Introduction- Biomass conversion techniques - Biogas Generation - Factors affecting biogas Generation, urban waste to energy conversion.

**Geothermal Sources:** Hydro thermal Source (Vapor & Liquid dominated systems), geothermal energy conversion

Tidal Energy-Basic Principles of Tidal Power, Schematic Layout of Tidal Power house, Advantages & Limitations of Tidal power.

Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3, CO4</th>
</tr>
</thead>
</table>

Guidelines for Conduction (Any one or more of following but not limited to)

- Guest Lectures
- Group Activities
- Assignments
- Taking up small project for short duration

Guidelines for Assessment (Any one or more of following but not limited to)
- Practical Test
- Presentation
- Paper
- (Theory assessment test)
- Report

**SUGGESTED LIST OF STUDENT ACTIVITYS**

1. Prepare a of monthly energy consumption of your institute and find the ways how it can be conserved
2. Conduct an energy audit of your institute; suggest the ways how the conventional energy resources utilization can be minimized. Suggest the areas, where the non-conventional energy may be used
3. Visit solar power plant / wind power plant available in your locality/ nearer to your institute and understand different elements, working, and note the power generation by these plants
4. Visit government website for renewable energy and find out different schemes run by government

**Text Books:**

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publication

**Reference Books:**

2. Energy opportunities and social responsibility. Satyesh C. Chakraborty, Jaico publications

**E-Books / E-Learning References:**

1. RENEWABLE ENERGY SOURCES AND THEIR APPLICATIONS:
2. http://nptel.ac.in/courses/112105051/
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
Mandatory Audit Course 6
314459 (B): Leadership and Personality Development

Teaching Scheme: Theory (TH) : 1 hrs/week
Tutorial (TUT): 3 hrs/week
(Assignments and Self-study)
Credit Scheme: Non Credit
Examination Scheme: Audit Course

Prerequisite Courses: if Any

Course Objectives:
1. To develop inter personal skills and be an effective goal oriented leader.
2. To develop personalities of students in order to empower them and get better insights into self-responsibilities in personal life to build better human being.
3. To develop professionals with leadership quality along with idealistic, practical and moral values.
4. To re-engineer attitude and understand its influence on behavior.
5. To help students to evolve as leaders who can effectively handle real life challenges in and across the dynamic environment.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Practice responsible decision-making and personal accountability.
CO2: Demonstrate an understanding of group dynamics and effective teamwork.
CO3: Develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others.
CO4: Develop multi-dimensional personality.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>PERSONALITY DEVELOPMENT</th>
<th>(03 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laws of Personality Development, Different Layers of Personality, How to Change Our Character, Influence of Thought, Take the Whole Responsibility on Yourself, Self-analysis: Johari ‘s Window, Attitude: Factors influencing Attitude, Challenges and lessons from Attitude, Personality Traits, Sharpening MemorySkills, Decision-Making, Negotiation and Problem-Solving. Importance of Self Confidence, Self Esteem, Creativity: Out of box thinking, Lateral Thinking</td>
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</table>

Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
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<table>
<thead>
<tr>
<th>Unit II</th>
<th>TECHNIQUES IN PERSONALITY DEVELOPMENT</th>
<th>(03 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Techniques for better Time Management, Meditation and concentration techniques, Self- hypnotism, Self-acceptance, and self-growth, Goal setting: Wish List, SMART Goals, Blueprint for success, Short Term, Long Term, Lifetime Goals. Confidence Building: Case studies, Confidence building videos of motivational speakers.</td>
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</tr>
</tbody>
</table>
Mapping of Course Outcomes for Unit II

CO1, CO2

Unit III
LEADERSHIP SKILLS
(03 hrs)

Working individually and in a team, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation, Introduction to Interpersonal Relations, Virtual Leadership: Introduction, Essential Skills for Managing Remote Teams and challenges of virtual leadership.

Mapping of Course Outcomes for Unit III

CO3, CO4

Unit IV
TEAM BUILDING
(03 hrs)

Importance of groups in organization and Team Interactions in group, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts., How to build a good team? Teamwork & Team building Interpersonal skills, Virtual team dynamics: issues and resolutions.

Mapping of Course Outcomes for Unit IV

CO2, CO4

Reference Books:

2. SKILLS, 2015, Career Development Centre, Green Pearl Publications.

E-Books/E-Learning References:

1. Developing Soft Skills and Personality: By Prof.T.Ravichandran, IIT Kanpur
https://onlinecourses.nptel.ac.in/noc19_hs32/preview
2. Leadership:Prof KalyanChakravatti, IIT Kharagpur
https://nptel.ac.in/courses/122/105/122105021/
3. Virtual leadership https://youtu.be/SNeTgBE93o
4. Motivation and Confidence building videos of motivational speakers like Shiv Khera, Sandeep Maheshwari, Sonu Sharma, Vivek Bindra, B.K.Shivani
Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)

Mandatory Audit Course 6
314459 (C): Foreign Language-(Japanese Language- IV)

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
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<th>Examination Scheme:</th>
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</thead>
<tbody>
<tr>
<td>Theory (TH): 1 hrs/week</td>
<td>Non Credit</td>
<td>Audit Course</td>
</tr>
<tr>
<td>Tutorial(TUT): 3 hrs/week</td>
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<td></td>
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<tr>
<td>(Assignments and Self-study)</td>
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</tbody>
</table>

Prerequisite Courses:
1. Students must have already studied can read/write Hiragana and Katakana script
2. Students must have studied Japanese for beginners that includes the syllabus of Audit course Module 1 to 3

Course Objectives:
1. Japan Market needs: To meet the needs of ever growing industry with respect to the Japanese language support.
2. Japanese Culture and Mindset: To get introduced to Japanese society and culture through language.
3. Career opportunities: To know more about Higher studies, Career opportunities in Japan /Japanese companies across the world.
4. Soft skills and self-development: To learn the manners, business culture and develop the confidence by gaining the knowledge of global perspective and cross-cultural studies.

Course Outcomes:
On completion of the course, students will be able to–
CO2: Demonstrate knowledge of Japanese Language Scripts (Reading, Writing, etc).
CO3: Demonstrate knowledge of Japanese culture, lifestyle, etc.
CO4: Pursue advanced Professional Japanese Language course.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>JAPANESE GRAMMAR</th>
<th>(3 hrs Lecture + 3 hrs Self-study)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving and Giving, Verb past tense, Negative, Make sentences using various adjectives, Culture/Others: Conversation/Essay about some place, Introduction to the tourism in Japan, Introduction to Business/Work culture in Japan, Kanjis: 41 to 50, Listening practice, Vocabulary and conversation practice</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference:
- Minna no Nihongo I : Lesson 7 and 8 (Text book + Audio and Video)
- Nihongo Challenge Kanji - Lesson 5
## Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
<th>INTERACTIVE JAPANESE</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Adverbs of degree, Stating like / dislike, Living and Non-living things, Stating wish/desire, Stating the present action (verb te form), Culture/Others: Introduction to Career Opportunities, Education and Higher studies in Japan, Kanjis: 51 to 60, Listening practice, Vocabulary and conversation practice</td>
</tr>
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</table>

### Reference:
- a. Minna no Nihongo I : Lesson 9 and 10 (Text book + Audio and Video)
- b. Nihongo Challenge Kanji - Lesson 6

## Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2</th>
<th>FORMAL JAPANESE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counters, Making comparisons, Past tense of verbs, Past tense of adjectives, Combining adjectives (i + i, na+i ...), Culture/Others: Information about career forums and Job Fairs, Introduction about Japanese companies recruitment process, Kanjis: 61 to 70, Listening practice, Vocabulary and conversation practice</td>
</tr>
</tbody>
</table>

### Reference:
- c. Minna no Nihongo Lesson 11 and 12 (Text book + Audio and Video)
- d. Nihongo Challenge Kanji - Lesson 7

## Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
<th>LIFE IN JAPAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stating wish/desire (ga hoshi, verb tai form), Stating / combining multiple actions (verb te form), Stating the order of multiple actions (verb te kara form), Expressing &quot;Permission&quot; and &quot;Prohibition&quot; (te mo ii, te wa ikenai forms), Culture/Others: Preparation of a job interview for a Japanese company, Do’s and Don’ts in a Job Interview, Kanjis: 71 to 80, Listening practice, Vocabulary and conversation practice</td>
</tr>
</tbody>
</table>

### Reference:
- a. Minna no Nihongo : Lesson 13 and 14 (Text book + Audio and Video)
- b. Nihongo Challenge Kanji - Lesson 8

## Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
<th>Text Books:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1. Minna no Nihongo I – Main Text book with audio and video files (Books by Goyal Publishers – Available in shops / Online)</td>
</tr>
<tr>
<td></td>
<td>2. Minna no Nihongo - Translation and grammatical notes for self-study (Books by Goyal Publishers Available in shops / Online)</td>
</tr>
<tr>
<td>Reference Books:</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1. Nihongo Shoho: For better understanding and practice of Basic Japanese Grammar</td>
<td></td>
</tr>
<tr>
<td>2. Marugoto : For scenario based Japanese conversation practice</td>
<td></td>
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</table>

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<thead>
<tr>
<th>E-Books / E-Learning References:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. nihongo ichiban</td>
</tr>
<tr>
<td>a. <a href="https://nihongoichiban.com/home/jlpt-n5-study-material/">https://nihongoichiban.com/home/jlpt-n5-study-material/</a></td>
</tr>
<tr>
<td>2. jlpt sensei</td>
</tr>
<tr>
<td>a. <a href="https://jlptsensei.com/how-to-pass-jlpt-n5-study-guide/">https://jlptsensei.com/how-to-pass-jlpt-n5-study-guide/</a></td>
</tr>
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