**ST. XAVIER'S COLLEGE(AUTONOMOUS)**

**Palayamkottai - 627 002**

**Recognized as "College with Potential for Excellence" by UGC**

**Accredited by NAAC at A++ Grade with a CGPA of 3.66 out of 4 in IV cycle**

# SYLLABUS

## M.Sc. COMPUTER SCIENCE

**(w.e.f June 2021)**

# Programme Name: M.Sc. Computer Science

**Programme Code: PCS**

## PROGRAMME SPECIFIC OUTCOMES

At the completion of the M.Sc. programme in Computer Science the students will be able to

- Have ability to communicate Computer Science concepts
- Use software development tools and Modern computing platforms
- Formulate solution for computing problems and provide arguments for the solutions.
- Design and implement software systems to meet the desired needs.
- Apply algorithms and mathematical concepts to design and analysis of software.
- Get employed in the field of software industry.
- Pursue research in the field of Computer Science.

## M. Sc. Computer SciencProgramme Structure

| Sem | Course Code | Title of the Course | Hours | Credits |
|---|---|---|---|---|
| I | 21PCS11 | Advanced Data Structures and Algorithms | 5 | 5 |
| | 21PCS12 | Advanced Database Management System | 5 | 5 |
| | 21PCS13 | Object Oriented Analysis and Design | 5 | 5 |
| | 21PCSE14 (Elective1) | Theory of Computation / Advanced System Programming / Logic Programming / Graph Theory | 5 | 5 |
| | 21PCS15 | Lab 1: Advanced Data Structures and Algorithms | 4 | 2 |
| | 21PCS16 | Lab 2: Advanced Database Management System | 4 | 2 |
| | | Library/Seminar | 2 | |
| | | ***Sub Total*** | ***30*** | ***24*** |
| II | 21PCS21 | Machine Learning with Python | 5 | 5 |
| | 21PCS22 | Web Application Development | 5 | 5 |
| | 21PCS23 | Compiler Design | 5 | 5 |
| | 21PCSE24 (Elective2) | MobileCommunication/Wireless Technology/Cyber Security / Cryptography | 5 | 5 |
| | 21PCS25 | Lab 3: Machine Learning with Python | 4 | 2 |
| | 21PCS26 | Lab 4: Web Application Development | 4 | 2 |
| | | Library/Seminar | 2 | |
| | | ***Sub Total*** | ***30*** | ***24*** |
| III | 21PCS31 | Mobile Application Development | 5 | 5 |
| | 21PCS32 | Data Mining and Data Warehousing | 5 | 5 |
| | 21PCS33 | Image Processing | 5 | 5 |
| | 21PCSE34 (Elective3) | Soft Computing/ Cloud Computing/Green Computing/ Grid Reality | 5 | 5 |
| | 21PCS35 | Lab 5: Mobile Application Development | 4 | 2 |
| | 21PCS36 | Lab 6: Data Mining and Image Processing | 4 | 2 |
| | 21PCS37 | Mini Project –Summer Internship | | 2 |
| | | Library/Seminar | 2 | |
| | | ***Sub Total*** | ***30*** | ***26*** |
| IV | 21PCS41 | Data Science Techniques | 5 | 5 |
| | 21PCS42 | J2EE | 5 | 5 |
| | 21PCS43 | Lab 7:J2EE | 6 | 3 |
| | 21PCS44 | Major Project | 10 | 3 |
| | | Library/Seminar | 4 | |
| | | ***Sub Total*** | ***30*** | ***16*** |
| | | **STAND** | | ***1*** |
| | | ***Total*** | ***120*** | ***91*** |

## Extra Credit Course

| Semester | Subject Code | Subject Title | Credits |
|---|---|---|---|
| I | 21PCSEC11 | Web Designing with Bootstrap and JQuery | 4 |
| II | 21PCSEC21 | Internet of Things | 4 |
| III | 21PCSEC31 | Big Data Analytics | 4 |
| IV | 21PCSEC41 | Artificial Intelligence and Machine Learning | 4 |

**ADVANCED DATA STRUCTURES AND ALGORITHMS**
**(Course code 21PCS11)**

| SEMESTER– I | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Define the fundamental concepts of Data Structures(K1)
- Describe rigorous correctness proofs for algorithms (K2)
- Demonstrate a familiarity with major algorithms and data structures(K3)
- Apply important algorithmic design paradigms and methods of analysis (K3).
- Analyze the asymptotic performance of algorithms(K4)
- Evaluate the correctness of algorithms using inductive proofs and invariants(K5)

## UNIT I FUNDAMENTALS

Mathematical Proof Techniques: Induction, proof by contradiction, direct proofs – Asymptotic Notations – Properties of Big-oh Notation –Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis — Recurrence Equations – Solving Recurrence Equations – Time-Space Tradeoff- NP Hard And NP-Complete Problems

## UNIT II HEAP STRUCTURES

Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps – Lazy-Binomial Heaps

## UNIT III NP-Hard and NP-COMPLETE PROBLEMS

Basic Concepts – Cook's theorem – NP-hard graph problems – NP hard scheduling problems –NP Hard code generation problem

## UNIT IV GREEDY METHOD

Greedy Method: General Method Knapsack Problem Job Sequencing with deadlines Minimum Spanning Trees -Single Source Shortest Path. Binary Search Trees – AVL Trees – Red-Black trees – Multi-way Search Trees –B-Trees – Splay Trees – Tries.

## UNIT V DYNAMIC PROGRAMMING and BACK TRACKING

Dynamic Programming: General Method, Multistage Graphs, All pair Shortest Paths - Optimal Binary Search Tree, 0/1 Knapsack, Reliability Design, Travelling Sales Person Problem. Back Tracking: General method- 8 Queen Problem -Sum of Subsets- Graph Coloring -Hamiltonian cycles.

## TEXTBOOKS

1.E. Horowitz, S Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, University .Press, 2007

2. E. Horowitz, S. Sahni and S Rajasekaran, Fundamentals of computer Algorithms, Second Edition, University Press,2008

## Reference Books


1. G.A.VijayalakshmiPai, “Data Structures and Algorithms Concepts, Techniques and Applications” , Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

2. Ellis Horowitz and Sartaj Sahani, “Fundamentals of Data Structures”, Computer Science Press Inc, Galgotia Book Sources Publishers, New Delhi., 2012

**ADVANCED DATABASE MANAGEMENT SYSTEM**
**(Course Code 21PCS12)**

| SEMESTER – I | HOURS – 5 | CREDITS - 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Define the conceptsof relational database(K1)
- Describe the usage of SQL commands (K2)
- Demonstrate query processing and optimization(K3)
- Apply transactional models and concurrency control concepts (K3).
- Analyze query optimization techniques(K4)
- Illustrate advanced indexing techniques and blockchain concepts(K4)

**UNIT I**

Introduction to Relational Databases: Structure of Relational Databases- Database Schema-Keys-Schema Diagrams-Relational Query Languages -The relational Algebra. Intermediate SQL- Views- Transactions-Integrity Constraints- SQL Data Types in SQL-Authorization. Advanced SQL: Accessing SQL from a Programming Language-Functions and Procedures-Triggers-Recursive Queries-Advanced Aggregation Features. Complex Data Types: Semi-structured Data-Object Orientation-Textual Data-Spatial Data.

**UNIT II**

Query Processing and Optimization: Query Processing-Measures of Query Cost-Selection operation-Sorting-Join Operation-Other Operations-Evaluation Expressions-Query Processing in Memory. Query Optimization: Transformation of Relational Expressions-Estimating Statistics of Expression Results-Choice of Evaluation Plans-Materialized Views-Advanced Topics in Query Optimization.

**UNIT III**

Transaction Concept: A simple Transactional model-Storage structure-Transactional Atomicity and Durability-Transaction Isolation-Serializability -Transaction Isolation and Atomicity-Transaction Isolation Levels-Implementation of Isolation Levels-Transactions as SQL Statements. Concurrency Control: Lock-Based Protocols-Deadlock Handling-Multiple Granularity-Insert operations, delete Operations and Predicate Reads-Timestamp-Based Protocols-Multi version Schemes-Weak Levels of Consistency in Practice-Advanced Topics in Concurrency Control.

**UNIT IV**

Parallel and Distributed Storage: Data Partitioning –dealing with skew in partitioning-Replication-Parallel Indexing-Distributed file Systems-Parallel key –Value Stores. Parallel and distributed Query Processing: Parallel Sort- Parallel Join- Query Processing on Shared-Memory architectures-Query Optimization for Parallel execution-Parallel Processing of streaming data-Distributed query processing-Parallel and distributed transaction processing: Distributed transactions-Commit protocols-concurrency control in distributed databases-replication-extended concurrency control protocols.

**UNIT V**

Advanced Indexing Techniques: Bloom Filter-Log-Structured Merge tree and variants-bitmap indices-Indexing of spatial data-hash Indices-Advanced application development: Performance tuning-Performance benchmarks-other issues in application development-standardization-distributed directory systems- Blockchain databases- Blockchain properties-Achieving blockchain properties via cryptographic hash functions-consensus-data management in a blockchain-smart contracts-performance enhancement-emerging applications.

**TEXT BOOK**

1. Abraham Silberschatz and Henry Korth and S., "Database System Concepts", Seventh Edition, McGraw Hill Education, 2020

**REFERENCE BOOK**

1. Alexis Leon and Mathews Leon, Fundamentals of Database Management Systems, Vijay Nicole Imprints, 2010

2. Subhash K Shindle Rini Chakrabarti, Shilbhadra Dasgupta, Advanced database Management System, Dreamtech press, 2014

**OBJECT ORIENTED ANALYSIS AND DESIGN**
**(Course Code:21PCS13)**

| SEMESTER – I | HOURS – 5 | CREDITS - 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Define the Object-based view of Systems. (K1)
- Describe robust object-based models for Systems (K2)
- Demonstrate robust software components. (K3)
- Illustrate various Models and collaborate them. (K3)
- Analyze and model software specifications. (K4)
- Analyze the testing phases in developing a software project (K4)

## UNIT I INTRODUCTION

Objects Oriented Analysis – Object Oriented Themes, Modeling as a Design Technique: Modeling – The Object Modeling Technique. Object Modeling: Object and Classes – Links and Associations – Advanced Link and Association Concepts – Generalization and Inheritance – Grouping Constructs, Advanced object Modeling: Aggregation – Abstract Classes – Generalization as extension and Restriction – Multiple Inheritance – Metadata – Candidate Key – Constraints.

## UNIT II DYNAMIC MODELING

Events and States – Operations – Nested State Diagrams – Concurrency – Advanced Dynamic Modeling Concepts – Relation of Object and Dynamic Models, Functional Modeling: Functional Models – Data Flow Diagrams – Specifying Operations – Constraints – Relation of Functional to Object and Dynamic Models, Methodology Preview: OMT as a Software Engineering Methodology – The OMT Methodology – Impact of an Object-Oriented Approach.

## UNIT III SYSTEM DESIGN

Overview of System Design – Breaking a System into sub Systems – Identifying Concurrency – Allocating Subsystems to Processors and Tasks – Management of Data Stores – Handling Global Resources – Choosing Software Control Implementation – Handling Boundary Conditions – Setting Trade off priorities – Common Architectural Frameworks – Architecture of the ATM machine, OBJECT Design: Overview of Object Design – Combining the Three Models – Designing Algorithms – Design Optimization – Implementation of Control – Adjustment of Inheritance – Design of Association – Object Representation – Physical Packaging – Documenting

## UNIT IV AN OVERVIEW of UML

Views- use case view-logical view-implementation view-process view-deployment view-diagrams-use case diagram object diagram-state machine-Activity diagram-interaction diagram-component diagram-deployment diagram composite structure diagram-model event general mechanism-adornments-comments-specifications.

## UNIT V USE CASE MODELING

Basics of use cases-use case diagram-system-action-finding actors-actors in UML-relationship between actors finding use cases-use cases in UML-relationship between use cases-generalization relationship-extend relationship-include relationship-organizing use cases-describing use cases-assessing use cases -testing use cases-use cases and requirement management.

## TEXT BOOK

1) James Rumbaugh Michael Blaha , William Premerlani, Frederick eddy and William Lorensen," Object Oriented Modeling and Design" , Pearson Education India., Second edition, 2011.

2) Hans Erik Erikson, Magnus Penker, Brian Lyons," UML 2 Tool kit" Wiley India Pvt. Ltd, OMG Press, 2008.

## REFERENCE BOOKS:

1) H.Srimathi, H.Sriram, A.Krishnamoorthy," Object oriented analysis and design using UML" Scitech publications Pvt. Ltd, 2006.

2) Simon Bennett, Steve Mcrobb, Rayfarmer," Object oriented system analysis and design using UML", Tata-MCGraw Hill Publishing company Ltd., 2010.

**ELECTIVE I**
**THEORY OF COMPUTATION**
**(Course Code: 21PCSE14)**

| Semester: I | Hours:5 | Credits:5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Describe about Theory of Computation(K1)
- Interpret automation theory in computation process (K2)
- Demonstrate computation concept in compiler development process(K3)
- Apply the skill to develop Turing Machine (K3)
- Illustrate about various Grammars and their patterns(K4)
- Analyze the concept of Computation Complexity(K4)

**UNIT I**

Mathematical Preliminaries and Notation-Three Basic Concepts-Finite Automata: Deterministic Finite -Nondeterministic Finite Accepters -Equivalence of Deterministic and Nondeterministic Finite Accepters-Reduction of the Number of States in Finite Automata-Regular Languages and Regular Grammars-Regular Expressions- Connection Between Regular Expressions and Regular Languages - Regular Grammars-Properties of Regular Languages.

**UNIT II**

Context-Free Languages: Context-Free Grammars-Examples of Context-Free Languages-Leftmost and Rightmost Derivations-Derivation Trees-Relation Between Sentential Forms and Derivation Trees-Parsing and Ambiguity-Parsing and Membership-Ambiguity in Grammars and Languages- Context-Free Grammars and Programming Languages-Two important Normal Forms.

**UNIT III**

Pushdown Automata: Non-deterministic Pushdown Automata-Definition of a Pushdown Automaton-The Language Accepted by a Pushdown Automaton- Pushdown Automata and Context-Free Languages-Pushdown Automata for Context-Free Languages-Context-Free Grammars for Pushdown Automata-Deterministic Pushdown Automata and Deterministic Context-Free Languages- Grammars for Deterministic Context-Free Languages.

**UNIT IV**

Turing Machines: The Standard Turing Machine-Definition of a Turing Machine-Turing Machines as Language Accepters-Turing Machines as Transducers- Combining Turing Machines for Complicated Tasks- Minor Variations on the Turing Machine Theme-Turing Machines with More Complex Storage-Multitape Turing Machines-Multidimensional Turing Machines-Nondeterministic Turing Machines-A Universal Turing Machine- Linear Bounded Automata.

**UNIT V**

A Hierarchy of Formal Languages and Automata: Recursive and Recursively Enumerable -Unrestricted -The Chomsky Hierarchy. An Overview of Computational Complexity: Efficiency of Computation- Turing Machine Models and Complexity- Language Families and Complexity Classes- The Complexity Classes P and NP - NP Problems- Polynomial-Time Reduction.

**TEXT BOOK:**

Peter Linz," An Introduction to formal Languages and Automata", Fifth Edition, Jones and Bartlett Learning, 2012.

**REFERENCE BOOKS:**

1. Hopcroft J. E., Motwani R and Ullman J. D, "Introduction to Automata Theory, languages and Computations", Second Edition, Pearson education, 2008.

2. John C. Martin, "Introduction to the Languages and the Theory of Computation", Third edition, Tata McGraw Hill Publishing Company, New Delhi 2007.

**ELECTIVE I**
**ADVANCED SYSTEM PROGRAMMING**

**(Course Code: 21PCSE14)**

| SEMESTER– I | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Describe the Concept of System Programming(K1)
- Explain the basics of assembler and Loader (K2)
- Apply the logic of system programming in programming languages(K3)
- Illustrate the usage of formal Systems in programming languages(K3)
- Demonstrate the usage of administration tools(K3)
- Analyze the role of System Programming in Various Programming languages(K4)

**UNIT I Background**

Machine Structure-Evolution of the Components of Programming System-Evolution of Operating Systems-Operating System User Viewpoint: Functions, Batch Control Language, Facilities – General Machine Structure – General approach to a new machine-Machine Structure -360 and 370.Machine Language - Assembly language.

**UNIT II Assemblers & Loaders**

General Design Procedure-Design of Assembler-Statement of problem-Data Structure-Format of Data Bases- Algorithm-Look for modularity-Loader Schemes- Compile and Go Loaders-General Loader Scheme-Absolute Loaders-Subroutine Linkages-Relocating Loaders-Direct-linking Loaders-Design of Absolute Loader.

**UNIT III Programming Languages**

Importance of High Level Languages-Features of High Level Languages-Data types and Data Structures –Character String – Bit String- Data Structures-Storage Allocation and Scope of Names-Storage Classes-Block Structure- Accessing Flexibility-Pointers-Label Variables and Label Arrays-Functional Modularity-Procedures-Recursion- Asynchronous Operation.

**UNIT IV Formal Systems**

Uses of Formal Systems in programming Languages-Language Specification-Syntax-directed Compliers-Complexity Structure Studies-Structure Analysis-Formal Specification-Approaching a formalism-Development of Formal Specification-Formal Grammars-Example of Formal Grammars-Derivation of Sentences-Sentential Forms and Sentences.

**UNIT V System Administration**

Duties of the Administrator, Administration tools, Overview of permissions - Processes: Process status, Killing processes, process priority. Starting up and Shut down: Peripherals,

Kernel loading, Console, the scheduler, Managing User Accounts: Principles, password file, Password security, Shadow file, Groups and the group file, Shells.

**TEXT BOOK**

John J.Donovan, "Systems Programming", 46th reprint, TATA McGraw-Hill

Edition, 2009.

**REFERENCES:**


1. Dhananjay M. Dhamdhere "System Programming and Operating Systems", Tata McGraw-Hill Publishing Company, Ltd, 2011
2. Adam Hoover," System Programming with C and Unix", Pearson ,2010

**ELECTIVE I**
**LOGIC PROGRAMMING**
**(Course Code: 21PCSE14)**

| SEMESTER– I | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Describe about elements of the Logic Programming(K1)
- Discuss the usage of built-in Procedures(K3)
- Apply the logic Programming with a variety of language elements(K3)
- Demonstrate the usage of logic and models in programming paradigm(K3)
- Illustrate the concept of designing and writing a well-structured program(K4)
- Illustrate structured flowcharts for report programs of varying levels of complexity and code the program(K4)

## UNIT I PROGRAMMING PARADIGMS

Programming Paradigms-Logic Programming-Prolog Syntax-Unification-Meaning ofProlog Programs-List Processing: Operators.

## UNIT II ARITHMETIC

Structures- controlling backtracking- Negation as Failures-Built-in Procedures.

## UNIT III GRAMMARS

Definite Clause Grammars-Meta Programming- Interpreters-constraint logic programming-Constraint satisfaction Problem-Practical Applications.

## UNIT IV LOGIC AND MODELS

Logic and Models-First Order Logic Model -Theory for Knowledge Representors-Semantic of Prolog Programs.

## UNIT V INDUCTIVE LOGIC PROGRAMMING

Inductive Logic Programming-Query Evaluation Strategies-Efficiency-Semantic web and Logic Programming.

## TEXT BOOK

Ivan Bratko, “Prolog Programming for Artificial Intelligence”, Fourth Edition, Addison-Wesley Publ. Co., 2012.

## REFERENCE BOOKS

1. W. F. Clocksin and C.S.Mellish, “Programming in Prolog”, Fourth Edition, Springer-Verlag, 2000.

2. Ulf Nilsson and Jan Maluszynki, “Logic Programming and Prolog”, Second Edition, 2000.

**ELECTIVE I**
**GRAPH THEORY**
**(Course Code:21PCSE14)**

| SEMESTER– I | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Describe about Graph Theory (K2)
- Summarize the usage of fundamental theorems of Graphs in Real Life Applications (K2)
- Explain the usage of matching and factors (K2)
- Illustrate the Connectivity and its usage(K3)
- Demonstrate graph Coloring concept(K3)
- Analyze the role of Planarity in various applications(K4)

**UNIT I**

Basic Results: Basic Concepts - Subgraphs - Degrees of Vertices - Paths and Connectedness Operations on Graphs - Directed Graphs: Basic Concepts - Tournaments.

**UNIT II**

Connectivity: Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, Trees:Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.

**UNIT III**

Independent Sets and Matchings: Vertex Independent Sets and Vertex Coverings - Edge Independent Sets -Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.

**UNIT IV**

Graph Colorings: Vertex Coloring - Critical Graphs - Triangle - Free Graphs - Edge Colorings of Graphs - Chromatic Polynomials.

**UNIT V**

Planarity:Planar and Non- planar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Color Theorem and the Heawood Five-Color Theorem-Kuratowski's Theorem.

**TEXTBOOK**

1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008.

**REFERENCE BOOKS**

1. R.J. Wilson, "Introduction to Graph Theory", Fourth Edition, Pearson Education, 2003.

2. R. Diestel, "Graph Theory", Springer-Verlag, 2nd edition, 2000.

## Lab 1: ADVANCED DATA STRUCTURESAND ALGORITHMS

**(Course Code: 21PCS15)**

| SEMESTER – I | HOURS – 4 | CREDITS – 2 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Illustrate the usage of Graph Structures (K4).
- Design applications using advanced Data Structures(K4)
- Evaluate the usage of Algorithmic Techniques(K5)
- Evaluate the correctness of algorithms using inductive proofs and invariants(K5)
- Design applications based on Greedy Method and Dynamic Programming(K6)
- Design applications using basic Data Structures(K6)

**List of Practical**

1. Stack and Queue
2. Binary Search
3. Greedy Knapsack Problem
4. Job Sequencing with deadlines
5. Minimum Cost Spanning Tree
6. Single Source Shortest Path
7. All Pair Shortest Path
8. 0/1 Knapsack
9. Travelling Sales Person Problem
10. 8-Queen Problem
11. Graph Coloring
12. Hamiltonian Cycle
13. Binomial Heaps
14. Longest common subsequence
15. Naive Algorithm

## Lab 2: ADVANCED DATABASE MANAGEMENT SYSTEM
## (Course Code: 21PCS16)

| SEMESTER – I | HOURS – 4 | CREDITS – 2 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Illustrate the usage of Graph Structures (K4).
- Design applications using advanced Data Structures(K4)
- Evaluate the usage of Algorithmic Techniques(K5)
- Evaluate the correctness of algorithms using inductive proofs and invariants(K5)
- Design applications based on Greedy Method and Dynamic Programming(K6)
- Design applications using basic Data Structures(K6)

**List of Programs**

1. Creating tables with various constraints.
2. Working with DDL, DML and TCL commands
3. Applying Join operations
4. Working with Grant and revoke commands
5. Applying Views operations
6. Retrieving rows with Sub Queries
7. Creating and dropping Index
8. Creating Parallel Query Processing
9. Applying basic Query optimization techniques
10. View deadlock occurrence with simple queries

**MACHINE LEARNING WITH PYTHON**
**(Course Code:21PCS21)**

| SEMESTER –II | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Describe the concepts of machine Learning (K1)
- Explain the fundamentals of Classification and probability theory (K2)
- Analyse the supervised learning techniques(K4)
- Analyse the un-supervised learning techniques(K4)
- Illustrate Big Data using machine learning(K4)
- Develop applications using Hadoop and Map Reduce(K6)

**UNIT I**

Classification - Machine learning basics - Key terminology - Key tasks of machine learning - How to choose the right algorithm - Steps in developing a machine learning application - Getting started with the NumPy library - Classifying with k-Nearest Neighbors - Classifying with distance measurements - Example: a handwriting recognition system - Splitting datasets one feature at a time: decision trees - Tree construction - Plotting trees in Python with Matplotlib annotations - Testing and storing the classifier.

**UNIT II**

Classifying with probability theory: naïve Bayes - Classifying with Bayesian decision theory - Classifying with conditional probabilities - Document classification with naïve Bayes - Classifying text with Python - Logistic regression - Classification with logistic regression - Using optimization to find the best regression - Support vector machines - Separating data with the maximum margin - Finding the maximum margin - Efficient optimization with the SMO algorithm - Speeding up optimization with the full Platt SMO - Using kernels for more complex data - Improving classification with the AdaBoost meta-algorithm - Classifiers using multiple samples of the dataset - Train: improving the classifier by focusing on errors - Creating a weak learner with a decision stump - Implementing the full AdaBoost algorithm - Test: classifying with AdaBoost.

**UNIT III**

Forecasting numeric values with regression - Finding best-fit lines with linear regression - Locally weighted linear regression - Shrinking coefficients to understand our data - The bias/variance tradeoff - Tree-based regression - Locally modeling complex data - Building trees with continuous and discrete features - Using CART for regression - Tree pruning - Model trees - Example: comparing tree methods to standard regression - Using Tkinter to create a GUI in Python.

**UNIT IV**

Unsupervised learning - Grouping unlabeled items using k-means clustering - The k-means clustering algorithm - Improving cluster performance with post processing - Bisecting k-means - Association analysis with the Apriori algorithm - Association analysis - The Apriori principle - Finding frequent itemsets with the Apriori algorithm - Mining association rules from frequent item sets - Efficiently finding frequent itemsets with FP-

growth - FP-trees: an efficient way to encode a dataset - Build an FP-tree - Mining frequent items from an FP-tree.

**UNIT V**

Using principal component analysis to simplify data - Dimensionality reduction techniques - Principal component analysis - Simplifying data with the singular value decomposition - Applications of the SVD - Matrix factorization - SVD in Python - Collaborative filtering–based recommendation - Big data and MapReduce - MapReduce: a framework for distributed computing - Hadoop Streaming - Running Hadoop jobs on Amazon Web Services - Machine learning in MapReduce - Using mrjob to automate MapReduce in Python - Example: the Pegasos algorithm for distributed SVMs.

**TEXT BOOK**

Peter Harrington," Machine Learning in Action", Manning Publications Co., 2012..

**REFERENCE BOOKS**

1. Willi Richert, Luis Pedro Coelho, "Building Machine Learning Systems with Python", Packt Publishing, 2013.

2. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media, 2016.

**WEB APPLICATION DEVELOPMENT**
**(Course Code:21PCS22)**

| SEMESTER –II | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Discuss different Frameworks (K2)
- Illustrate PHP as a server-side programming language (K3)
- Outline the principles behind using MySQL as a backend DBMS with PHP(K4)
- Describe JavaScript as a dynamic webpage creating tool (K2)
- Create composer packages(K6)
- Develop dynamic websites (K6)

**UNIT I**

Bootstrap: Introduction - Basic Example - Container - Jumbotron - Button - Grid - Table - Form - Alert - Wells - Badge - Panels - Image - Glyphicon - Carousel - List Group - Dropdown - Collapse - Tabs - Navbar - Input types - Modals – Popover.

**UNIT II**

JavaScript: Introduction - Basic Example - Internal and External Javascript - Comment - Variable - Function - Control Statements - Loops - JS Objects: Js Object - Array - String - Math. JS DOM: Document Object - getElementById - getElementsByName() - getElementsByTagName() – innerHTML - innerText.PHP& MySQL: Connecting to MySQL - Making MySQL Queries - Basic CRUD Operations using PHP and MySQL.

**UNIT III**

Laravel: Overview - Features - MVC Architecture - Advantages of Laravel - Installation - Application Structure - Configuration - Routing - Middleware - Namespaces - Controllers.

**UNIT IV**

Laravel: Request - Cookie - Session - Response - Forms - Views - Blade - Redirections - Working with database - Errors and Logging - Localization.

**UNIT V**

Laravel: Validation - File uploading - Sending Email - AJAX - Error Handling - Event Handling - CSRF Protection.

**TEXT BOOKS:**

1. Paul Deital, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How to Program", Pearson, Fifth Edition, 2012.

2. Matt Lambert, "Learning Bootstrap 4", Packt Publishing, Second Edition, 2016.

3. Steve Suehring,Tim Converse and Joyce Park, "PHP 6 and MySQL Bible", Wiley India Pvt.Ltd.(Reprint 2014)

4. Matt Stauffer,"Laravel Up & Running", O'Reilly Media, 2017

**REFERENCE BOOKS:**

1. W.Jason Gilmore, "Beginning PHP and MySQL from Novice to Professional", Second Edition, Apress, 2007.

2. Nathan Wu, "Learning Laravel 5", 2016.

**COMPILER DESIGN**
**(Course Code: 21PCS23)**

| SEMESTER –II | HOURS –5 | CREDITS –5 |
|---|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Describe the concepts of Compiler Design Processing(K1)
- Explain the process of Compiler Design Phases (K2)
- Demonstrate the usage of various Compiler Phases in compiler Development(K3)
- Illustrate about Run-Time Environment issues(K4)
- Illustrate the process involved in Code Generation Process(K4)
- Evaluate the processing of Paring Algorithms (K5)

**UNIT I**

Language Processors-The Structure of a Compiler-The Evolution of Programming Languages-The Science of Building a Compiler-Applications of Compiler Technology- A Simple Syntax-Directed Translator -Syntax-Directed Translation -Symbol Tables.

**UNIT II**

Lexical Analysis: The role of the lexical analyzer –Input buffering –Specification of tokens –Recognition of tokens –A language of specifying lexical analyzers –Finite automata –From a regular expression to an NFA –Design of a lexical analyzer generator –Optimization of DFA-based pattern matchers.

**UNIT III**

Syntax Analysis: The role of the parser –Context-free grammar –Writing a grammar –Top-down parsing –Bottom-up parsing -Operator-precedence parsing –LR parsers –Using ambiguous grammars –Parser generator.

**UNIT IV**

Run-Time Environment: Storage organization –Stack Allocation of Space-Access to Nonlocal Data on the Stack-Heap Management-Introduction to Garbage Collection-Introduction to Trace-Based Collection.

**UNIT V**

Code Generation: Issues in the design of a code generator –Target Language –Basic blocks and flow - optimization of basic blocks –Peephole optimization –the principal sources of optimization – introduction to data flow analysis.

**TEXT BOOK:**

Alfred V. Aho, Ravi Sethi, Jeffrey D.Ullman. “Compilers Principles, Techniques and Tools”, 2nd Edition, Addison Wesley Publishing Company, 2007.

**REFERENCE BOOKS:**

1. A.V. AhoAndJd Ullman "The Principles of Compiler Design", Narosa Publishing House, 2002.

2. D.M.Dhamdhere, “Compiler Construction –Principles and Practices”, Macmillon India Limited, 2005.

**ELECTIVE – II**
**MOBILE COMMUNICATION**
**(Course Code :21PCSE24)**

| SEMESTER –II | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:**Upon completion of the course the student will be able to

- Understand the concepts of Mobile Communications (K2)
- Illustrate the generations of telecommunication systems in wireless network (K2)
- Understand the architecture of Wireless LAN technologies (K2)
- Explain the functionality of Transport and Application layer (K2)
- Learn the functionality of network layer and Identify a routing protocol for a given Ad hoc networks (K3)
- Illustrate WAP Architecture(K4)

**UNIT I**

Introduction: Medium Access Control: Motivation for Specialized MAC -SDMA - FDMA - TDMA - CDMA - Comparison of Access mechanisms - Telecommunications: GSM

**UNIT II**

Satellite Systems: Basics - Routing - Localization - Handover - Broadcast Systems: Overview - Cyclic Repetition of Data - Digital Audio Broadcasting - Digital Video Broadcasting. Wireless Networks: Wireless LAN: Infrared Vs Radio Transmission -Infrastructure Networks - Ad hoc Networks - IEEE 802.11

**UNIT III**

Mobile Network Layer: Mobile IP: Goals - Assumptions and Requirement -Entities - IP packet Delivery - Agent Advertisement and Discovery -Registration - Tunneling and Encapsulation - Optimization - Reverse Tunneling- IPv6 - DHCP - Ad hoc Networks.

**UNIT IV**

Mobile Transport Layer: Traditional TCP - Indirect TCP - Snooping TCP -Mobile TCP - Fast retransmit/ Fast Recovery - Transmission/ Timeout Freezing- Selective Retransmission - Transaction Oriented TCP.

**UNIT V**

WAP: Architecture - Datagram Protocol - Transport Layer Security -Transaction Protocol - Session Protocol - Application Environment – Wireless Telephony Application.

**TEXT BOOKS :**

1. Jochen Schiller, "Mobile Communications",2nd Edition, eighth impression, Pearson Education, 2011.

2. William Stallings, "Wireless Communications and Networks", Pearson Education, 2009.

**REFERENCES**

1. William C.Y.Lee, Mobile Communication Design Fundamentals, John Wiley, 1993.

2. William Stallings, Wireless Communication and Networks, PHI/ Pearson Education, 2003.

3. Singhal, WAP-Wireless Application Protocol, Pearson Education, 2003.

4. Asoke K Talukder, Roopa R Yavagal, "Mobile computing", TMG, 2006.

**ELECTIVE – II**
**WIRELESS TECHNOLOGY**
**(Course Code: 21PCSE24)**

| SEMESTER –II | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Describe the overview of Wireless Networks (K2)
- Describe the fundamental concepts of transmission techniques (K2)
- Demonstrate the principles of wireless networks (K3)
- Illustrate the concept of GSM, TDMA, CDMA and various technologies(K4)
- Illustrate the concept of ADHOC network(K4)
- Illustrate the concept of Bluetooth(K4)

**UNIT I**

Overview of wireless Networks: Introduction, different generation of wireless networks, characteristics of wireless medium: Introduction- Radio propagation mechanism - path- loss modeling and signal coverage effects of multipath and Doppler - channel measurement and modeling techniques- simulation of the radio channel.

**UNIT II**

Physical layer alternatives for wireless networks: Networks - applied wireless transmission techniques-short distance baseband transmission - UWB pulse transmission - Carrier modulated transmission - traditional digital cellular transmission - broadband modems for higher speeds - spread spectrum transmission -high speed modems for spread spectrum transmission - diversity and smartreceiving techniques.

**UNIT III**

Principles of wireless networks: Network planning: Introduction - wireless network topologies - cellular topology - cell fundamentals - signal to interference calculation - capacity expansion techniques - network planning for CDMA systems -wireless network operations: Introduction - mobility management – radioresources and power management - security in wireless networks.

**UNIT IV**

GSM and TDMA technology: Introduction – GSM - Mechanisms to support a mobile environment - communication in the infrastructure. CDMA technology -IS – 95 and IMT – 2000 – introduction - reference architecture for North Americansystems – CDMA - IMT – 2000. Mobile data networks: Introduction - the data oriented CDPD networks - GPRS and higher data rates - short messaging service in GSM - Mobile application protocols.

**UNIT V**

Local BROADBAND and AD HOC networks: Introduction to wireless LAN: Introduction - evolution of the WLAN industry - IEEE 802.11 WLANS: Introduction- IEEE 802.11 - The PHY LAYER - MAC Sublayer - MAC management sublayer - Wireless ATM – HIPHERLAN - HIPHERLAN-2 - Ad Hoc networking and WPAN - wireless ATM and HIPHERLAN - IEEE 802.15 WPAN - Home RF - Bluetooth - wireless geolocation systems: wireless geolocation -wireless geolocation system architecture.

**TEXT BOOK:**

1.KavehPahlavan and Prashant Krishnamurthy, “Principles of wireless Networks”, Pearson education, 2004.

**REFERENCE BOOKS:**

1. William Stallings, “Wireless Communications and Networks”, Second Edition, PHI,2008.

2. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education,2009.

**ELECTIVE – II**
**CYBER SECURITY**
**(Course Code: 21PCSE24)**

| SEMESTER –II | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Define fundamentals of cyber security (K2).
- Describe a comprehensive overview of the different facets of Cyber Security (K2).
- Apply authentication and cryptography techniques (K3).
- Analyze risk management and protection from the cyber threats (K4).
- Illustrate Cyber Security with Cyber Laws both in Global and Indian Legal environments (K4).
- Summarize different Cyber Crimes, Threats and Laws (K5).

**UNIT I CYBER SECURITY FUNDAMENTALS**

As Architecture Authentication Authorization Accountability, Social Media, Social Networking and Cyber Security.

Cyber Laws, IT Act 2000-IT Act 2008-Laws for Cyber-Security, Comprehensive National Cyber-Security Initiative CNCI – Legalities.

**UNIT II CYBER ATTACK AND CYBER SERVICES**

Computer Virus – Computer Worms – Trojan horse.Vulnerabilities- Phishing- Online Attacks – Pharming - Phoarging – CyberAttacks - Cyber Threats - Zombie- stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood.

**UNIT III CYBER SECURITY MANAGEMENT**

Risk Management and Assessment - Risk Management Process - Threat Determination Process -Risk Assessment - Risk Management Lifecycle.

Security Policy Management - Security Policies - Coverage Matrix, Business Continuity Planning – Disaster Types - Disaster Recovery Plan - Business Continuity Planning Process.

**UNIT IV VULNERABILITY**

Vulnerability - Assessment and Tools: Vulnerability Testing - Penetration Testing Black box-white box., Architectural Integration: Security Zones – Devicesviz Routers, Firewalls, DMZ. Configuration Management - Certification and Accreditation for Cyber-Security.

## UNIT V AUTHENTICATION AND CRYPTOGRAPHY

Authentication and Cryptography: Authentication - Cryptosystems - Certificate Services Securing Communications: Securing Services - Transport – Wireless - Steganography and NTFS Data Streams., Intrusion Detection and Prevention Systems: Intrusion - Defense in Depth - IDS/IPS -IDS/IPS Weakness and Forensic Analysis, Cyber Evolution: Cyber Organization - Cyber Future.

## TEXT BOOKS:

1. Matt Bishop, Introduction to Computer Security, Pearson, 6th impression, 2005.

2. Thomas R, Justin Peltier, John, Information Security Fundamentals, Auerbach Publications, 2013.

3. AtulKahate, Cryptography and Network Security 2nd Edition, Tata McGrawHill, 2013.

## REFERENCE BOOKS:

1. Nina Godbole, SunitBelapure, Cyber Security, Wiley India I Edition 2011.

2. Jennifer L. Bayuk and Jason Healey and Paul Rohmeyer and Marcus Sachs, Cyber Security Policy Guidebook, Wiley; IEdition , 2012.

3. Dan Shoemaker and Wm. Arthur Conklin, Cybersecurity: The Essential Body ofKnowledge, Delmar Cengage Learning; 1 Edition ,2011.

**ELECTIVE – II**
**CRYPTOGRAPHY**
**(Course Code: 18PCSE24)**

| SEMESTER –II | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon Completion of the course, the students should be able to:

- Understand basics of Cryptography. (K2)
- Understand Public-Key Infrastructure. (K2)
- Understand the most common type of cryptographic algorithm (K2)
- Compare and analyses various Cryptographic Techniques (K2)
- Design Secure applications (K6)
- Inject secure coding in the developed applications (K6**)**

## UNIT I INTRODUCTION AND CLASSICAL ENCRYPTION TECHNIQUES

Security Trends – security services – Symmetric cipher model –Substitution techniques – Transposition techniques – Rotor Machines – Steganography.

## UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY

Data Encryption Standard-Block cipher principles-block cipher modes of operation- The strength of DES – Differential and Linear Cryptanalysis –Block Cipher Design Principles - Advanced Encryption Standard (AES)- Evaluation criteria for AES - The AES Cipher. Triple DES-Blowfish-RC5 algorithm.

## UNIT III PUBLIC KEY CRYPTOGRAPHY

Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography.

## UNIT IV HASH FUNCTIONS

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC.

## UNIT V DIGITAL SIGNATURES

Digital signatures - authentication protocols – Digital Signature Standard – ElGamal – Schnorr.

**TEXT BOOKS:**

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013.

2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.

**REFERENCE BOOKS:**

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.

2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.

## LAB 3: MACHINE LEARNING WITH PYTHON
## (Course Code: 21PCS25)

| SEMESTER –II | HOURS – 4 | CREDITS – 2 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Use Google colab environment (K3)
- Apply the concepts of machine Learning (K3)
- Illustrate the fundamentals of Classification and probability theory (K4)
- Analyse the supervised learning techniques(K4)
- Analyse the un-supervised learning techniques(K4)
- Develop handwriting recognition system(K6)

**List of Practical**

1. Basic python programs using Google colab environment
2. Classification Algorithms Examples
3. Implementing Naïve Bayes classification algorithm
4. Implementing Adaboost classification algorithm
5. Clustering algorithm Examples
6. Implementing k-means clustering algorithm
7. Implementing Apriori algorithm
8. Implementing a handwriting recognition system

## Lab 4: WEB APPLICATION DEVELOPMENT
## (Course Code 21PCS26)

| SEMESTER –II | HOURS – 4 | CREDITS – 2 |
|---|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Use the concepts of web application development (K3)
- Apply JavaScript as a dynamic webpage creating tool(K3)
- Demonstrate PHP as a server-side programming language (K3)
- Integrate various techniques to develop creative web applications (K6)
- Build applications using MySQL as a backend with PHP(K6)
- Develop applications with Validations(K6)

**List of Programs**

1. Bootstrap Containers and grid
2. Bootstrap tables
3. Bootstrap alert, Badge and modals
4. Bootstrap collapse and Tabs
5. Form validation using JavaScript
6. Calculator using JavaScript and AJAX
7. Store Student Marks in Database
8. Display Student marks from Database
9. Login form using cookies & session
10. Simple Laravel Program
11. Program using Routing
12. Employee Profile
13. Forms using CSRF Protection
14. Program using cookies
15. Form validations
16. Registration form using database

## MOBILE APPLICATION DEVELOPMENT

**(Course Code: 21PCS31)**

| SEMESTER –III | HOURS – 5 | CREDITS – 5 |
|---|---|---|

Course Outcomes: Upon completion of the course the students will be able to

- Identify the advantages of React Native (K1)
- Know how to create simple App (K2)
- Express the Project structure (K2)
- Implement the various components and Elements (K3)
- Examining the native modules (K3)
- Executing Platform specific components (K3)

### UNIT I

Getting started with React Native - Introducing React and React Native - Understanding how React Native works - React Native's strengths - React Native's drawbacks - Creating and using basic components - Understanding React: Managing component data using state - Managing component data using props -React component specifications - React lifecycle methods - Building first React Native app - Laying out the todo app - Coding the todo app - Opening the developer menu -Continuing building the todo app.

### UNIT II

Developing applications in React Native: Introduction to styling - Applying and organizing styles in React Native - Styling view components - Styling Text components - Styling in depth - Platform-specific sizes and styles - Using transformations to move, rotate, scale, and skew components - Using flexbox to lay out components.

### UNIT III

Navigation - React Native navigation vs. web navigation - Building a navigation-based app - Persisting data - Using DrawerNavigator to create drawer-basednavigation - Animations - Introducing the Animated API - Animating a form input to expand on focus - Creating a custom loading animation usinginterpolation - Creating multiple parallel animations - Creating an animated sequence - Using Animated. Stagger to stagger animation starttimes - Other useful tips for using the Animated library-Using the Redux data architecture library - Redux Introduction - Using context to create and manage global state in a Reactapplication - Implementing Redux with a React Native app - Creating Redux reducers to hold Redux state - Adding the provider and creating the store - Accessing data using the connect function - Adding actions -Deleting items from a Redux store in a reducer.

**UNIT IV**

Implementing cross‑platform APIs - Using the Alert API to create cross-platform notifications - Using the AppState API to detect the current application state - Using the AsyncStorage API to persist data - Using the Clipboard API to copy text into the user's clipboard - Using the Dimensions API to get the user'sscreen information - Using the Geolocation API to get the user's current location information - Using the Keyboard API to control the location andfunctionality of the native keyboard - Using NetInfo to get the user's current online/offline status - Getting information about touch and gesture events withPanResponder.

**UNIT V**

Implementing iOS-specific components and APIs - Targeting platform-specific code – DatePickerIOS - Using PickerIOS to work with lists of values -Using ProgressViewIOS to show loading indicators - Using SegmentedControlIOS to create horizontal tab bars - Using TabBarIOS to render tabs at the bottom ofthe UI - Using ActionSheetIOS to show action or share sheets - Implementing Android-specific components and APIs - Creating a menu using DrawerLayoutAndroid - Creating a toolbar with ToolbarAndroid - Implementing scrollable paging with ViewPagerAndroid - Using the DatePickerAndroid API to show a native datepicker - Creating a time picker with TimePickerAndroid - Implementing Android toasts using ToastAndroid.

**TEXT BOOK:**

Nader Dabit, "React Native in Action", Manning Publications Co., 2019.

**REFERENCE BOOKS:**

1. Bonnie Eisenman, "Learning React Native - Building Native Mobile Apps with JavaScript", SECOND EDITION, O'Reilly Media, Inc.,2018.

2. Jonathan Lebensold, "React Native Cookbook",O'Reilly Media, Inc.,2018.

## DATAMINING AND DATA WAREHOUSING
## (Course Code: 18PCS32)

| SEMESTER –III | HOURS – 5 | CREDITS – 5 |
|---|---|---|

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

- Design a Data warehouse system and perform business analysis with OLAP tools. (K2)
- Know the fundamentals of data mining (K2)
- Apply suitable pre-processing and visualization techniques for data analysis. (K3)
- Apply frequent pattern and association rule mining techniques for data analysis (K3)
- Apply appropriate classification and clustering techniques for data analysis (K3)
- Evaluate data mining algorithms and understand how to choose algorithms for different analysis tasks (K5)

**UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)**

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

**UNIT II DATA MINING – INTRODUCTION**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III DATA MINING – FREQUENT PATTERN ANALYSIS**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

**UNIT IV CLASSIFICATION AND CLUSTERING**

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster Analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

**UNIT V WEKA TOOL**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

**TEXT BOOK:**

Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

**REFERENCE BOOKS:**

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", Tata M cGraw – Hill Edition, 35th Reprint , 2016.

2. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.

3. Ian H.Witten and Eibe Frank ,"Data Mining: Practical Machine Learning Tools and Techniques", Elsevier, Second Edition, 2005.

## IMAGE PROCESSING
## (Course Code:21PCS33)

| SEMESTER –III | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcome:** Upon completion of the course the student will be able to

- Describe image processing Concepts(K1)
- Explain about Image Interpolation (K2).
- Illustrate the mechanism of Image Enhancement(K3)
- Apply Image Restoration Techniques(K3)
- Illustrate Image representation and recognition(K4)
- Develop applications using Image Segmentation (K6).

### UNIT I DIGITAL IMAGE FUNDAMENTALS

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition : Image Acquisition using Single Sensor, Sensor Strips, Sensor Arrays – Image Sampling and Quantization : Basic concepts – Representing Digital Images - Image Interpolation – Relationships between pixels .

### UNIT II IMAGE ENHANCEMENT

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

### UNIT III IMAGE RESTORATION AND SEGMENTATION

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering. Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing.

### UNIT IV IMAGE COMPRESSION & MORPHOLOGICAL IMAGE PROCESSING

Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Transform Coding - Wavelet coding – Morphological : Gray Scale Morphology Erosion & Dilation – Opening & Closing – Gray Scale Morphological Reconstruction .

### UNIT V IMAGE REPRESENTATION AND RECOGNITION

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching-Structural Methods.

**TEXT BOOK**

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018.

**REFERENCE BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt. Ltd., 2011.

2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.

3. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.

4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

**ELECTIVE III**
**SOFT COMPUTING**
**(Course Code 21PCSE34)**

| SEMESTER –III | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcome:** Upon completion of the course the student will be able to

- Describe Artificial Neural Network (K1)
- Explain the ideas of fuzzy sets, fuzzy logic (K2)
- Use heuristics based on human experience. (K3)
- Apply genetic algorithms and classification (K3)
- Analyze the working of human brain using ANN. (K4)
- Analyze the applications which can use soft computing techniques. (K4)

## UNIT I INTRODUCTION

Introduction to Neural Networks – Fuzzy Logic – Genetic Algorithm - Hybrid Systems – Soft Computing. Artificial Neural Network: An Introduction – Fundamental Concepts –Evolution of Neural Networks Basic Models- Important Terminologies. Supervised Learning Network : Introduction – Perceptron Networks- Adaptive Linear Neuron- Multiple Adaptive Linear Neuron – Back Propagation Network.

## UNIT II ASSOCIATIVE MEMORY NETWORKS AND UNSUPERVISED LEARNING NETWORKS

Introduction –Training algorithms – Auto associative Memory Network – Bidirectional Associative Memory- Hopfield Networks. Unsupervised Learning Networks: Introduction – Fixed Weight Competitive Nets – Kohonen Self-Organized-Learning Vector Quantization.

## UNIT III FUZZY LOGIC

Classical sets and Fuzzy sets: Introduction – Classical Sets – Fuzzy Sets – Classical Relations – Fuzzy Relations. Membership Functions: Introduction – Features – Fuzzification – Methods – Defuzzification Lambda Cuts- Methods. Fuzzy Arithmetic

## UNIT IV GENETIC ALGORITHMS

Introduction – Basic Operators and Terminologies General Genetic Algorithm – Classification – Holland Classifier Systems – Genetic Programming.

## UNIT V APPLICATIONS OF SOFT COMPUTING

ANFIS – Adaptive Neuro Fuzzy Inference Systems- Architecture – Coactive Neuro Fuzzy Modeling. Applications: A fusion approach of Multispectral Images with SAR image for flood area analysis Optimization of TSP using Genetic Algorithm- Soft Computing Based Hybrid Fuzzy Controllers.

**TEXT BOOK**:

1. S.N.Sivanandam, S.N.Deepa," Principles of Soft Computing", Wiley-India,2007.

**REFERENCE BOOKS:**

1.TimothyJ.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.

2.S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.

3.J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Eastern Economy Edition 2007.

4. Davis E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 2003.

**ELECTIVE III**
**CLOUD COMPUTING**
**(Course Code: 21PCSE34)**

| SEMESTER –III | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Describe the broad perceptive of cloud architecture and model(K1)
- Discuss the concept of Virtualization(K2)
- Illustrate the features of cloud simulator(K3)
- Analyze the design of cloud Services(K4)
- Assess cloud Computing system(K5)
- Develop cloud-based architecture(K6)

**UNIT I**

**Introduction** - Cloud computing at a glance - Historical developments - Building cloud computing environments - Principles of Parallel and Distributed Computing - Eras of computing - Parallel vs. distributed computing - Elements of parallel computing - Elements of distributed computing - Components of a distributed system - Architectural styles for distributed computing - Technologies for distributed computing - Service-oriented computing.

**UNIT II**

**Virtualization** - Characteristics of virtualized environments - Increased security - Taxonomy of virtualization techniques - Virtualization and cloud computing - Pros and cons of virtualization - Xen: paravirtualization - VMware: full virtualization - Microsoft Hyper-V - Cloud Computing Architecture - The cloud reference model - Infrastructure- and hardware-as-a-service - Platform as a service - Software as a service - Types of clouds - Economics of the cloud - Open challenges.

**UNIT III**

**Cloud application programming** - Aneka - Framework overview - Anatomy of the Aneka container - Building Aneka clouds - Private cloud deployment mode - Public cloud deployment mode - Hybrid cloud deployment mode - Cloud programming and management - Aneka SDK - Management tools - Data-Intensive Computing - Characterizing data-intensive computations - Technologies for data-intensive computing - Aneka MapReduce programming - Introducing the MapReduce programming model - Example application.

**UNIT IV**

**Cloud Platforms in Industry** - Amazon web services - Compute services - Storage services - Google AppEngine - Architecture and core concepts - Microsoft Azure - Azure core concepts - SQL Azure - Windows Azure platform appliance - Cloud Applications - Scientific applications - Business and consumer applications - Social networking - Media applications - Multiplayer online gaming

**UNIT V**

**Security in the Cloud** - Cloud Security Challenges - Software-as-a-Service Security - Security Management - Security Governance - Risk Management - Risk Assessment - Security Portfolio Management - Security Awareness - Education and Training Policies, Standards, and Guidelines - Secure Software Development Life Cycle - Security Architecture Design - Vulnerability Assessment - Data Privacy - Data Governance - Data Security - Identity Access Management (IAM) -- Data Privacy - Change Management - Business Continuity and Disaster Recovery.

**TEXT BOOKS**:


1. RajkumarBuyya, Christian Vecchiola, S.TamaraiSelvi, 'Mastering Cloud Computing", Tata McGraw Hill Education Private Limited,2013.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010


**REFERENCES:**


1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.

3. Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure", Wiley India, 2011.

4. Gautam Shroff, Enterprise Cloud Computing, Cambridge University Press, 2011.

**ELECTIVE III**
**GREEN COMPUTING**
**(Course Code 21PCSE34)**

| SEMESTER –III | HOURS – 5 | CREDITS –5 |
|---|---|---|

**Course Outcome**: Upon completion of the course the student will be able to

- Describe about reducing the usage of hazardous materials (K1)
- Discuss Deep Green Computing (K2)
- Describe about reducing Greenhouse Gas Emissions (K3)
- Examine energy efficiency during the product's lifetime (K3)
- Illustrate the use of cloud computing in green computing (K4)
- Select go green technique to overcome climate change (K5)

**UNIT I**

Green Computing and Saving Money: Key Concepts – Why Saving Money Is Green – Getting Focused on Money- Saving Efforts – Implementing Energy Efficiency – Changing How Current Devices Are Used – Moving to Cloud Services – Digitizing Non-IT Functions – Greening Your Energy-Saving Moves – Some Big Thinking About Money- Saving Efforts

Green Computing and the Environment: Key Concepts – Environmental Drivers for Green Computing –Green Agenda– Key Roots of Environmentalism – Environmentalism and IT – The New Imperative of Climate Change – A Brief History of the Climate and Climate Change – The 2°C Warming "Limit" – Climate Change and IT –Next with Climate Change – What It Means to "Go Green" – Why IT Is a Climate Change Solution – Career Development and "Going Green"

**UNIT II**

A New Vision of Computing: Key Concepts – Cloud Computing Emerges – The End of the PC Era – Some New- Model IT – Challenges – A Few Examples from a Multinational – How a Company Adopted the iPhone – A Mental Model for IT Simplicity – Why Green Computing Fits the New Model – Is Cloud Computing the Whole Answer? – Disadvantages of Cloud Computing – Managing Disadvantages of Cloud Computing – What to Do Besides Cloud Computing – Efficiency and Cloud Computing – Greenability and Cloud Computing – Responsibility, Usability, and Cloud Computing – The Philosophical Implications of Green Computing – The Zen of Green Computing. Building a Green Device Portfolio : Key Concepts – Introduction – Why Green Works for Device Purchases – Pushing Computing Down the Device Pyramid – Another Dimension of Device Pyramid Greenness – Green Computing and Embodied Energy – Green Computing and Running Costs – Planned Obsolescence Isn't Green – Green Computing and Device Disposal – The Greenpeace Guide to Greener Electronics – Support Employees' Device Choices – Publicizing Your Process.

**UNIT III**

Green Servers and Data Centers: Key Concepts – Choosing and Creating Green Data Centers – Green Data Centers as a Model – The Last Shall Be First –Data Center Green – Building

and Power Supply Considerations – Servers, Storage, and Networking – Data Center SuppliersSaving Energy: Key Concepts – Saving Energy Serves Many Masters – Cost Savings through Energy Savings – Risk Reduction through Energy Savings – Carbon Footprint Reduction through Energy Savings – Improving Your Reputation and Brand – Why Energy Prices Will Stay High –Embodied Energy – Analyzing Your Energy Usage – A Recipe for Energy Savings – Understanding the Unique Energy Needs of IT – Focusing on Solar Power – Saving Energy and the Supply Chain – Energy-Saving Pilot Projects – Selling Energy Savings

**UNIT IV**

Reducing Greenhouse Gas Emissions: Key Concepts – Why Greenhouse Gas Emissions Are Important – Sources and Sinks of Greenhouse Gases and Warming –Reducing Emissions I: Embodied Energy – Reducing Emissions II: Daily Energy Use – Reducing Emissions III: Taking Steps to Use Different Sources – Reducing Emissions IV: Supply Chain Success.

Reducing Resource Use: Key Concepts – Why Resource Use Is Important – A Resource Use Checklist – Planned Obsolescence and Resource Use – The Story of Apple and EPEAT – Case Study: Computer Hardware and RSI.

**UNIT V**

Green Computing by Industry Segment: Key Concepts – Evaluating Greenness – The Newsweek – Green 500 Approach – Looking at Industry Segments – Analyzing Your Own Initiatives, Company, and Sector. The Future: Deep Green Computing: Key Concepts – Green Computing and the Future – Megatrends for Green Computing – An Increasing Need for Sustainability – The Continually Decreasing Cost of Core Computing Capabilities – The Ability of Computing to Do More and More Telepresence Instead of Travel – Telecommuting Instead of Commuting – Toward Deep Green Computing – Platforms for Deep Green Computing – Selling Deep Green Computing.

**Text Book:**

1.Bud E. Smith, Green Computing Tools and Techniques for Saving Energy, Money and Resources, CRC Press, 2014.

**Reference Books:**

1.TobyVelte, Anthony Velte, Robert Elsenpeter, Green IT, McGraw Hill, 2008.

2.AlvinGalea, Michael Schaefer, Mike Ebbers, Green Data Center: Steps for the Journey, Shroff Publishers and Distributers, 2011.

**ELECTIVE III**
**GRID COMPUTING**
**(21PCSE34)**

| SEMESTER –III | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Describe the concept of Grid Computing (K1)
- Explain the ideas of fuzzy sets, fuzzy logic (K2)
- Use heuristics based on human experience. (K3)
- Apply genetic algorithms and classification (K3)
- Analyze the working of human brain using ANN. (K4)
- Analyze the applications which can use soft computing techniques. (K4)

**UNIT I**

Introduction: Grid versus other Distributed systems-motivation for using Grid- Grid architecture: Basic Concepts-Some standard grids-quick overview of grid projects. Data Management: Data management requirements-functionalities of data management-metadata service in grids-replication-effective data transfer.

**UNIT II**

Grid Scheduling and information services: Job mapping and scheduling-Service Monitoring and discovery-Grid Workflow- fault tolerance in grids-Security in grid computing: Authentication-Authorization-Confidentiality-Trust and security in a grid environment-Getting started with GSI

**UNIT III**

Grid Middleware: Overview of Grid Middleware-Services on Grid Middleware- Grid middleware-Architecture overview of Grid Projects: Introduction of grid projects-Security in Grid Projects-Data Management in Grid Projects-Information services in Grid Projects-Job Scheduling in Grid Projects-Grid Applications.

**UNIT IV**

GRID Monitoring : Grid Monitoring Architecture (GMA) – An overview of Grid Monitoring systems – Grid ICE – JAMM – MDs – Network Weather Service – R – GMA – other Monitoring systems .

**UNIT V**

Grid Security and Resource Management: Grid Security – A Brief security primer – PRI – X509 Certificates – Grid security – Grid Scheduling and Resource management –Scheduling paradigms – Working principles of scheduling – A review of condor, SGE, PBS and LSF – Grid scheduling with QoS.

**TEXT BOOK**:


1. Frederic Magoules, JiePan, Kiat An Tan,Abhinit Kumar" Introduction to Grid Computing", CRC Press, 2009.
2. Maozhen Li, Mark Baker ,The Grid : Core Technologies , Wiley Publishers, 2005.


**REFERENCE BOOKS:**


1. Ian Foster, Carl Kesselman, The Grid 2: Blueprint for a New Computing Infrastructure, Elsevier Series, 2004.

2. Vladimir Silva, Grid Computing for Developers, Charles River Media, January 2006.

## LAB 5: MOBILE APPLICATION DEVELOPMENT
## (Course Code 21PCS35)

| SEMESTER –III | HOURS – 4 | CREDITS – 2 |
|---|---|---|

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

- Apply the basic elements (K3)
- Implement the components (K3)
- Use the Persistent storage (K3)
- Use various Animations (K3)
- Display Remote Images (K3)
- Build App with API (K6)

**List of Programs**

1. Layout with Flexbox
2. Breaking down a UI into Components
3. Dealing with the Keyboard
4. Listing Data with the FlatList
5. Persistent Storage
6. Dealing with Remote Images on Slow Networks
7. Playing with Animations
8. Complex Navigation Structure
9. Build a Swiper Component
10. Making a Declarative API for an Imperative API

## Lab 6: DATA MINING AND IMAGE PROCESSING
## (Course Code: 21PCS36)

| SEMESTER –III | HOURS – 4 | CREDITS – 2 |
|---|---|---|

**Course Outcomes:**Upon completion of the course the student will be able to

- Apply different file formats used to store data set (K3)
- Experiment Preprocessing of data (K3)
- Illustrate frequent pattern finding using association rule mining (K4)
- Classify the dataset using supervised learning methods (K4)
- Illustrate Clustering of dataset using unsupervised learning methods. (K4)
- Analyze Prediction Using regressions. (K4)

**List of Practical Using Weka**

1. File formats
2. Data Preprocessing
3. Association rule mining
4. Classification
5. Prediction
6. Cluster analysis

**List of Practical Using MatLab**

7. Point-to-Point transformation
8. Geometric Transformation
9. Linear and non-Linear Filtering
10. Morphological Operations

**DATA SCIENCE TECHINQUES**
**(Course Code 21PCS41)**

| SEMESTER –IV | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcome:** Upon completion of the course the student will be able to

- Describe about data science process. (K1)
- Interpret the ability to build and assess data-based models. (K2)
- Use data analysis with professional software. (K3)
- Determine to be an ethical data scientist. (K3)
- Summarize social network and data journalism. (K5)
- Demonstrate skill in data visualization. (K6)

**UNIT I**

Data science in a big data world: Benefits and uses of data science and big data - Facets of data - The data science process - The big data ecosystem and data science - An introductory working example of Hadoop.

The data science process: Overview of the data science process - Step 1: Defining research goals and creating a project charter - Step 2: Retrieving data - Step 3: Cleansing, integrating, and transforming data - Step 4: Exploratory data analysis - Step 5: Build the models - Step 6: Presenting findings and building applications on top of them.

**UNIT II**

Handling large data on a single computer: The problems you face when handling large data - General techniques for handling large volumes of data - General programming tips for dealing with large data sets - Case study 1: Predicting malicious URLs - Case study 2: Building a recommender system inside a database.

First steps in big data: Distributing data storage and processing with frameworks - Case study: Assessing risk when loaning money.

**UNIT III**

Join the NoSQL movement: Introduction to NoSQL - Case study.

The rise of graph databases: Introducing connected data and graph databases - Introducing Neo4j: a graph database - Connected data example: a recipe recommendation engine

Text mining and text analytics: Text mining in the real world - Text mining techniques - Case study: Classifying Reddit posts.

**UNIT IV**

Data Visualization and Fraud Detection: Data Visualization History - Gabriel Tarde Mark's Thought Experiment - Redux - Processing - Franco Moretti - A Sample of Data Visualization Projects - Mark's Data Visualization Projects - New York Times Lobby: Moveable Type - Project Cascade: Lives on a Screen - Cronkite Plaza - eBay Transactions and Books - Public Theater Shakespeare Machine - Goals of These Exhibits - Data Science and Risk - About Square - The Risk Challenge - The Trouble with Performance Estimation - Model Building Tips - Data Visualization at Square - Ian's Thought Experiment - Data Visualization for the Rest of Us. Social Networks and Data Journalism: Social Network Analysis at Morning Analytics - Case-Attribute Data versus Social Network Data - Social Network Analysis - Terminology from Social Networks - Centrality Measures - The Industry of Centrality Measures - Thought Experiment - Morningside Analytics - How Visualizations Help Us Find Schools of Fish - More Background on Social Network Analysis from a Statistical Point of View - Representations of Networks and Eigenvalue Centrality - A First Example of Random Graphs: The Erdos-Renyi Model - A Second Example of Random Graphs: The Exponential Random Graph Model - Data Journalism - A Bit of History on Data Journalism - Writing Technical Journalism: Advice from an Expert.

**UNIT V**

Lessons Learned from Data Competitions: Data Leakage and Model Evaluation: - Claudia's Data Scientist Profile - The Life of a Chief Data Scientist - On Being a Female Data Scientist - Data Mining Competitions - How to Be a Good Modeler - Data Leakage - Market Predictions - Amazon Case Study: Big Spenders - A Jewelry Sampling Problem - IBM Customer Targeting - Breast Cancer Detection - Pneumonia Prediction - How to Avoid Leakage - Evaluating Models - Accuracy: Meh - Probabilities Matter, Not 0s and 1s - Choosing an Algorithm - A Final Example - Parting Thoughts. Next-Generation Data Scientists, Hubris, and Ethics: Data Science - Next-Gen Data Scientists - Being Problem Solvers - Cultivating Soft Skills - Being Question Askers - Being an Ethical Data Scientist - Career Advice.

**TEXT BOOKS:**

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications Co., 2016.

2. RachelSchutt, Caathy O'Neil, "Doing Data Science", O'Reilly Publication, 2013.

**REFERENCE BOOKS:**

1. Joel Grus, "Data Science from Scratch", O'Reilly Publication, 2015.

2. Avrim Blum, John Hopcroft, and Ravindran Kannan, "Foundations of Data Science", ebook, 2019.

**J2EE**
**(Course Code: 21PCS42)**

| SEMESTER –IV | HOURS – 5 | CREDITS – 5 |
|---|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Gain the theoretical and practical knowledge about servlets and JSP (K1)
- Demonstrate and improve the knowledge about distributed systems and Web services (K1)
- Ability to develop the application based on servlets and JSP (K2,K3)
- Ability to solve the real-world problems using concepts like JDBC (K3)
- Analyze and design web-based information systems using HTML and JavaScript (K3, K6)

**UNIT I**

Understanding Java and the J2EE platform: Brief History of Java – Examining the origin of J2EE – Application components – roles – J2EE API's . Studying Servlet Programming: Introduction –creating html login screen- servlet structure and life cycle methods – writing servlet – servlet context – URL redirection – session tracking with servlets – cookies – URL rewriting – hidden fields – session tracking object with HttpSession Object –Login Servlet example – Listeners – Filters- deploying servlets- web application archive – web.xml deployment descriptor – applet servlet communication.

**UNIT II**

Java Database Connectivity: Introduction – JDBC Driver types – creating first JDBC program – retrieving data – database error processing – processing result sets – resultset metadata class – scrollable result set – preparedstatement class – callablestatement class – performing batch updates – using savepoints – configuring jdbc-odbc bridge – database connection pools and data sources – using row set interface.

**UNIT III**

JSP Basics – JSP scripting elements and Directives –Declarations – Expressions – Directives – Scriplets – Comments – Actions – Implicit JSP Objects – error Pages using JavaBean in JSP – Creating a Login using JavaBean - embedded control flow statements .

**UNIT IV**

The JSP Engine - Multithreading and persistence - the implicit objects - the JSP cycle – Sending Information-setting Cookies-Handling errors. Tracking Sessions : Tracking data between request.

**UNIT V**

Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's& vectors logical clocks. Web Services: Introduction, Understanding the SOAP message architecture, Explaining WSDL, Examining UDDI, Integrating J2EE and Web services.

**TEXT BOOKS :**

1. James McGovern, Rahim Adatia et al, "J2EE 1.4 Bible", Wiley, 2011.

2. Damon, Hougland, Aaron Tavistock, "Core JSP", Prentice Hall, 2001.

3. Coulouris, Dollimore and Kindberg, "Distributed System: Concepts and Design", Pearson Education,2012.

**REFERENCE BOOKS**

1. Luca Collebrusco ,"A Handbook On J2Ee And Xml Development", ", Tritech Digital Media, 2018.

2. Dan Rubel, "Designing web services with the j2ee 1.4 platform" :jax-rpc, soap, and xml, Prentice Hall, 2009.

3. Richard Monson Haefel, "Ultimate Guide J2EE Web Services", Pearson Education Limited, 2007.

4. Aaron E Walsh, "J2EE 1.4 A Professional Guide", Wiley India Pvt. Limited, 2003.

5. Jim Keogh, "The Complete Reference J2EE", Tata McGraw Hill, 2002.

6. Justin Couch and Daniel H. Steinberg, "J2EE Bible", Dreamtect India, 2002.

**Lab 7: J2EE**
**(Course Code: 21PCS43)**

| SEMESTER –IV | HOURS – 6 | CREDITS – 3 |
|---|---|---|

**Course Outcomes:** By the end of the course the students must be able to

- Describe the usage of Generic servlet (K2)
- Demonstrate the use of scriplets, implicit objects and control flow statements in servlets(K3)
- Apply the concepts of Hidden field direction, Cookies and Session tracking servlet and JSP(K3)
- Illustrate servlet and JSP programs to access the given database(K4)
- Use JSP programs to interact with Java Bean(K3)
- Select suitable SQL commands to manage the database (K5)

**List of Practical**

1. Write simple programs with Servlet
2. Write programs using JDBC with database
3. Develop Cookies using JSP
4. Develop programs using JDBC in JSP

**Servlet**

1. Simple Servlet Program using GenericServlet
2. Program for Login Page using HttpServlet
3. Program to implement Hidden field direction
4. Program to implement Session tracking in Servlet
5. Program to implement Cookies in Servlet
6. Program for JDBC to insert, update and delete records to and from database using Servlet
7. Program to display employee details in tabular format using Servlet

**JSP**

8. Program for voting eligibility using JSP
9. Program using Scriplets of JSP
10. Program using embedded control flow statement
11. Program to implement Session tracking
12. Program to implement Cookie in JSP
13. Program to implement implicit objects of JSP.
14. JSP interact with Java Bean
15. Program for JDBC to insert, update and delete records to and from database using JSP
16. Program to display student details in tabular format using JSP.

## EXTRA CREDIT COURSES

## WEB DESIGNING WITH BOOTSTRAP AND JQUERY
## (Course Code: 21PCSEC11)

| SEMESTER –I | CREDITS – 4 |
|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Define Bootstrap Environment (K1)
- Describe the usage of Bootstrap Layout Components (K2)
- use Bootstrap Layout Components (K3)
- Apply Bootstrap Navigation Elements (K3)
- Illustrate the usage of jQuery(K4)
- Summarize the concept of JSON (K5)

### UNIT I

Bootstrap: Introduction – Overview – Environment Setup – Bootstrap With CSS: Grid System – CSS – Typography – Tables - Forms – Buttons – Images – Helper Classes – Responsive Utilities.

### UNIT II

Bootstrap Layout Components: Glypicons – Dropdowns – Button Groups – Button Dropdown – Input groups – Breadcrumb - Clearfix – Star Rating – Tooltip – Picker.

### UNIT III

Bootstrap: Navbar – Navigation Elements – Pagination – Labels – Badges – Jumbotron – Page Header – Thumbnails – Alerts – Progress Bars – Media Object – List Group – Panels – Wells – Carousel - Tabs/Pills – Modals – Popover – Scrollspy.

### UNIT IV

Jquery: Introduction – Overview – Basics – Selectors – Effects – hide – show – toggle – slideToggle – animate – delay – text() – val – css – before – prepand – append – after – insertAfter – remove – clone – empty – attr - wrapall – unwrap – serialize – serializeArray – Jquery Events.

### UNIT V

JSON : Introduction - Basic Example - Object - Array - Comments - Parse JSON Data - XML: Introduction - Features - Basic Example - Attributes - Comments - Validation - DTD - XML Parsers.

### TEXT BOOKS

1. Paul Deital, Harvey Deitel & Abbey Deitel,, "Internet and World Wide Web - How to Program", Pearson, Fifth Edition, 2012.

2. Matt Lambert, "Learning Bootstrap 4", Packt Publishing, Second Edition, 2016.

**INTERNET OF THINGS**
**(Course Code: 21PCSEC21)**

| **SEMESTER –II** | **CREDITS –4** |
|---|---|

**Course Outcomes**: Upon completion of the course the student will be able to

- Describe basic concept of Internet of Things(K1)
- Explain the methodology of using IoT Devices (K2)
- Analyze the real-life problems for providing technology-based solutions(K4)
- Illustrate IoT Platform Design Methodology(K4)
- Illustrate IoT Physical Servers and Cloud Offerings(K4)
- Design machine to machine communication systems (K6)

**UNIT-I**

Introduction and Concepts: Introduction-Physical Design of IoT-Logical Design of IoT–IoT Enabling Technologies-IoT Levels and Deployment Templates.

**UNIT-II**

Domain Specific IoTs: Home Automation-Cities-Environment-Energy- Retail-Logistics-Agriculture-Industry-Health and Lifestyle. IoT and M2M:M2M-Difference between IoT and M2M–SDN and NFV for IoT. IoT System Management with NETCONF-YANG:Need for IoT Systems Management-Simple Network Management Protocol (SNMP)-Network Operator Requirements-NETCONF-YANG-IoT Systems Management with NETCONF-YANG.

**UNIT-III**

IoT Platforms Design Methodology: Introduction–IoT Design Methodology-Case Study on IoT System for Weather Monitoring – Motivation for using Python. IoT Systems-Logical Design using Python: Introduction – Installing Python-Python Data Types and Data Structures-Control Flow–Functions-Modules-Packages –File Handling -Date/Time Operations-Classes- Python Packages of Interest for IoT.

**UNIT-IV**

Building IoTWith Raspberry PiIoT Physical Devices and Endpoints: IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks - Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms.

**UNIT-V**

IoT Physical Servers and Cloud Offerings: Introduction to CloudStorage Models and Communication APIs – Xively Cloud for IoT – Python Web Application Framework-Django – Designing a RESTful WebAPI–AmazonWeb Services for IoT– SkyNet IoT Messaging Platform. Case Studies Illustrating IoT Design: Home Automation - Cities - Environment – Agriculture- Productivity Applications.

**TEXT BOOK:**

Arshdeep Bahga and Vijay Madisetti, “InternetofThings – A Hands On Approach”, UniversitiesPress(India), 2015.

**REFERENCE BOOKS:**


1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
3. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
4. Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

**BIG DATA ANALYTICS**
**(Course Code: 21PCSEC31)**

| SEMESTER –II | CREDITS –4 |
|---|---|

**Course Outcomes**:Upon completion of the course the student will be able to

- Describe the fundamental concepts of big data and analytics. (K2)
- Experiment the tools and practices for working with big data(K3)
- Determine the requirement of the integration of large amounts of data. (K3)
- Analyze the concept of stream computing (K4)
- Summarize how big data analytics can leverage into a key component (K5)
- Select appropriate tool for handling large amount of data (K5)

## UNIT I INTRODUCTION TO BIG DATA

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

## UNIT II INTRODUCTION HADOOP

Big Data – Apache Hadoop and Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

## UNIT III HADOOP ARCHITECTURE

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, HadoopMapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH &Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

## UNIT IV HIVE AND HIVEQL, HBASE

Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins &Subqueries, HBase concepts-Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

## UNIT V MINING DATA STREAMS

introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window -

Real time Analytics Platform (RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions

**TEXT BOOKS:**

1. Borislublinsky, Kevin T. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, 2015.

2. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.

3. Jure Leskovec and Rajaraman, Jeffrey David Ullman. Mining of Massive Datasets: 3rd Edition. Cambridge University Press. February 2020.

**REFERENCE BOOKS:**

1.Raj Kamal, Preeti Saxena, "Big Data Analytics", McGraw Hill, 2019.

2.Tom White, “HADOOP: The definitive Guide” , O Reilly 2012.

**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**
**(Course Code: 21PCSEC41)**

| **SEMESTER –IV** | **CREDITS –4** |
|---|---|

**Course Outcomes:** Upon completion of the course the student will be able to

- Define basic concepts of Artificial Intelligence and machine learning. (K1)
- Explain how knowledge is represented in machines (K2).
- Analyze different models of learning. (K4)
- Apply various learning models (K3)
- Design hybrid machine learning model (K6)
- Evaluate the performance of various Algorithms (K6)

**UNIT I**

Introduction – Types of Artificial Intelligence – Timeline of AI – Production Systems – Branches of AI – Applications of AI. Heuristic search techniques - Hill Climbing - Search Techniques - Depth First Search - Breadth First Search - Greedy Method - Best First Search Algorithm - A* Algorithm - Problem Reduction - The AO* Algorithm - Constraints Satisfaction - Means-ends Analysis.

**UNIT II**

Game playing - MINIMAX Procedure - Alpha-Beta Pruning - Combined Approach - Knowledge representation - Knowledge Management - Value of Knowledge Management - Categories of Knowledge - Types of Knowledge - Knowledge Representation - Approaches to Knowledge Representation - Issues in Knowledge Representation - Knowledge Base.

**UNIT III**

Knowledge representation structures - First-order Logic - Frames - Conceptual Dependency - Scripts - Semantic Network. Reasoning - Types of Reasoning - Non-monotonic Inference Methods - Non-monotonic Reasoning - Truth Maintenance Systems - Reasoning with Fuzzy Logic - Rule-based Reasoning - Diagnosis Reasoning - Case-based Reasoning Systems - Model-based Reasoning Systems.

**UNIT IV**

Learning - Types of Learning - Machine Learning - Learning Systems - Machine Learning Applications - Intelligent Agents. Association learning - Basics of Association - Apriori Algorithm - Eclat Algorithm - FP Growth Algorithm - Tertius Algorithm - Case Studies - Customer Sequence: Apriori Algorithm - Bank Loan Status: Association Rule Formation - Comparison of Associate Rule Algorithms - SCADA Application by FP Growth Algorithm. Reinforcement learning - Markov Decision Problem - Q-learning - Temporal Difference Learning - Learning Automata - Case Studies - Super Mario: Reinforced Learning .

**UNIT V**

Artificial neural nets - ANN Basics - ANN—Learning Process - Types of Networks - Perceptron - Multilayer Perceptron - Error Back-propagation Algorithm - RBF Networks - ANN Summary - supervised learning - Support Vector Machines - Inductive Logic

Programming - Generic ILP Algorithm - Case-based Reasoning - Ensemble Classifiers - AdaBoost - Bayes Optimal Classifier - Nearest Neighbourhood - Fuzzy Network - Info Fuzzy Networks - Fuzzy Neural Systems .

**TEXT BOOKS:**

1. Vinod Chandra S.S. and Anand Hareendran S., "Artificial Intelligence and Machine Learning", PHI Learning Private Limited, 2014.

**REFERENCE BOOKS:**

1. Christopher Bishop, Pattern Recognition and machine learning; Springer Verlag, 2006.

2. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2010.