**ANNAMALAI UNIVERSITY**

**(Affiliated Colleges)**

**411. Master of Computer Applications**

Programme Structure and Scheme of Examination (under CBCS)

(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Code** | **Course Title** | **Credit** | **Hours / Week** | **Examination Duration (Hrs)** | **Marks** |
| **CIA** | **ESE** | **Total** |
|  | **Semester-I** |
| A | 23PMCAC11 | **Core I :** Discrete Mathematics | 4 | 6 | 3 | 25 | 75 | 100 |
| 23PMCAC12 | **Core II:** Linux and shell programming | 5 | 7 | 3 | 25 | 75 | 100 |
| 23PMCAC13 | **Core-III:** Advanced Java Programming | 5 | 7 | 3 | 25 | 75 | 100 |
| 23PMCAE14-123PMCAE14-2 | **Elective – I:**Data Engineering and Management with Lab (Practical) (or) High Performance Computing with Lab (Practical) | 3 | 5 | 3 | 25 | 75 | 100 |
| 23PMCAE15-123PMCAE15-2 | **Elective – II:**Dot Net Technologies with lab (Practical) (or)Architecture and Frameworks with lab (Practical) |  3 | 5 | 3 | 25 | 75 | 100 |
|  | **Total** | **20** | **30** |  |  |  | **500** |

|  |  |
| --- | --- |
|  | **Semester-II** |
| A | 23PMCAC21 | **Core-IV:** Data Structures and Algorithms | 5 | 6 | 25 | 75 | 100 |
| 23PMCAC22 | **Core-V:** Advanced Computer Network | 5 | 6 | 25 | 75 | 100 |
| 23PMCAP23 | **Core –VI** : Practical - I: Data Structures and Algorithms Lab | 4 | 6 | 25 | 75 | 100 |
| 23PMCAE24-1/ | **Elective- III:** Cryptography and Network Security Lab (Practical) (or)  | 3 | 4 | 25 | 75 | 100 |
| 23PMCAE24-2 | Network Protocols Lab (Practical) |
| 23PMCAE25-123PMCAE25-2 | **Elective –IV :** Computer Vision Lab (Practical) (or) Solution Architecture Lab (Practical) | 3 | 4 | 25 | 75 | 100 |
| B (i) | 23PMCAS26 | **Skill Enhancement Course [SEC] – I:** Software Development Technologies  | 2 | 4 | 25 | 75 | 100 |
|  | **Total** | **22** | **30** |  |  | **600** |

|  |  |
| --- | --- |
| A | **Semester III** |
| 23PMCAC31 | **Core-VII:** Python Programming | 5 | 6 | 25 | 75 | 100 |
| 23PMCAC32 | **Core-VIII :** Web Technology | 5 | 6 | 25 | 75 | 100 |
| 23PMCAC33 | **Core-IX :** Advanced Machine Learning(AML) Techniques | 5 | 6 | 25 | 75 | 100 |
| 23PMCAP34 | **Core-X :** Practical - II:Integrated Technology (AML) Lab | 4 | 6 | 25 | 75 | 100 |
| 23PMCAE35-123PMCAE35-2 |  **Elective-V:** Mobile Computing (or) Mobile Computing Application Development Lab (Practical) | 3 | 3 | 25 | 75 | 100 |
| B (i) | 23PMCAS36-123PMCAS36-2  | **Skill Enhancement Course [SEC]-II:**Web Technologies Lab (Practical)(or) Social Networking Lab (Practical) | 2 | 3 | 25 | 75 | 100 |
| B (ii) | 23PMCAI37 | Summer Internship \* | 2 | - | 25 | 75 | 100 |
|  |  |  | **26** | **30** |  |  | **700** |

|  |
| --- |
|  **Semester-IV** |
| A | 23PMCAC41 | **Core–XI :** Industry Dynamics Technology - Data Visualisation | 5 | 6 | 25 | 75 | 100 |
| 23PMCAC42 | **Core–XII:** Big Data Analytics | 5 | 6 | 25 | 75 | 100 |
| 23PMCAD43 | Project with Viva Voce | 7 | 10 | 25 | 75 | 100 |
| 23PMCAE44-123PMCAE44-2 | **Elective – VI:**[20% Theory + 80% Practical] \*\*Soft Computing & Lab (Practical) **(or)**Internet of Things & Lab (Practical) | 3 | 4 | 25 | 75 | 100 |
| B (i) | 23PMCAS45 -123PMCAS45 -2 | **Skill Enhancement Course [SEC]-III**Cyber Security Lab (Practical) (OR) Blockchain Technology Lab (Practical) | 2 | 4 | 25 | 75 | 100 |
| C | 23PMCAX46 | Extension Activity | 1 | - | 100 | - | 100 |
|  |  | **Total**  |  **23** | **30** |  | **600** |
|  |  | **Grand Total**  | **91** | **120** |  | **2400** |

\* Students should complete two weeks of internship before the commencement of III semester.

\*\* Evaluation is to be done both for theory (15 marks) and practical (60 marks) components separately by the examiners who will be conducting the practical and the marks should be awarded out of 75. Questions for the theory and practical are to be set by the concerned examiners.

**Credit Distribution**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Study Components** | **Papers** | **Total Credits** | **Marks/Sub** | **Total Marks** |
| Core Theory | 12 | 57 | 100 | 1200 |
| Core Electives | 6 | 18 | 100 | 600 |
| Skill Enhancement CoursesSEC1, SEC2, SEC3 | 3 | 6 | 100 | 300 |
| Internship/Industrial Activity(Carried out in Summer Vacation at the end of I Year – Two Weeks Period) | 1 | 2 | 100 | 100 |
| Project | 1 | 7 | 100 | 100 |
| Extension Activity | 1 | 1 | 100 | 100 |
|  | **24** | **91** |  | **2400** |

**Credit Distribution for PG Science Programme**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part** | **Course Details** | **No. of courses** | **Credit per course** | **Total Credit** |
| **A** | Core Theory  | 10 | 4/5 | **49** |
| Core Practical  | 2 | 4 | **8** |
| Elective Course | 6 | 3 | **18** |
| Project Work with VIVA-VOCE | 1 | 7 | **7** |
| **B(i)** | Skill Enhancement Course  | 3 | 2 | **6** |
| **B(ii)** | Summer Internship | 1 | 2 | **2** |
| **C** | Extension Activity | 1 | 1 | **1** |
|  |  |  |  | **91** |

**Component-wise Credit Distribution**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Courses** | **Sem I** | **Sem II** | **Sem III** | **Sem IV** | **Total** |
| **A** | Core (including Practical and Project) | 14 | 14 | 19 | 17 | **64** |
| Elective  | 6 | 6 | 3 | 3 | **18** |
| **B(i)** | Skill Enhancement Course | - | 2 | 2 | 2 | **6** |
| **B(ii)** | Summer Internship | - | - | 2 | - | **2** |
| **C** | Extension Activity | - | - | - | 1 | **1** |
|  |  |  |  |  |  | **91** |

**Part A and B(i) component will be taken into account for CGPA calculation for the post graduate programme and the other components Part B(ii) and C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining PG degree**.

|  |  |
| --- | --- |
| **Programme Outcomes (Pos)** | **PO1: Problem Solving Skill**Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.**PO2: Decision Making Skill**Foster analytical and critical thinking abilities for data-based decision-making.**PO3: Ethical Value**Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.**PO4: Communication Skill**Ability to develop communication, managerial and interpersonal skills.**PO5: Individual and Team Leadership Skill**Capability to lead themselves and the team to achieve organizational goals.**PO6: Employability Skill**Inculcate contemporary business practices to enhance employability skills in the competitive environment.**PO7: Entrepreneurial Skill**Equip with skills and competencies to become an entrepreneur.**PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society.**PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective.**PO 10: Moral and ethical awareness/reasoning**Ability to embrace moral/ethical values in conducting one’s life.  |
| **Programme Specific Outcomes****(PSOs)** | **PSO1 – Placement**To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.**PSO 2 - Entrepreneur**To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.**PSO3 – Research and Development**Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.**PSO4 – Contribution to Business World**To produce employable, ethical and innovative professionals to sustain in the dynamic business world.**PSO 5 – Contribution to the Society**To contribute to the development of the society by collaborating with stakeholders for mutual benefit. |

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| --- | --- | --- |
| **SEMESTER: I****PART-A****CORE-I** | 23PMCAC11: DISCRETE MATHEMATICS | **Credit:4****Hours:6** |

**Course Objectives**

* To know the concepts of relations and functions
* To distinguish among different normal forms and quantifiers
* To solve recurrence relations and permutations & combinations
* To know and solve matrices, rank of matrix & characteristic equations
* To study the graphs and its types

### Unit-I

**Relations**- Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations–– Representation of a relation by a matrix -Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function

### Unit-II

**Mathematical Logic**-Logical connectives-**Well formed formulas** – Truth table of well formed formula –Algebra of proposition –Quine’s method- **Normal forms of well formed formulas**- Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-**Rules of Inference for propositional calculus** – **Quantifiers**- Universal Quantifiers- Existential Quantifiers

### Unit-III

**Recurrence Relations**- Formulation -solving recurrence Relation by Iteration- solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two- Solving Linear Non homogeneous Recurrence Relations. **Permutations**-Cyclic permutation- Permutations with repetitions- permutations of sets with indistinguishable objects- **Combinations**- Combinations with repetition

### Unit-IV

### Matrices- special types of matrices-Determinants-Inverse of a square matrix-Cramer’s rule for solving linear equations-Elementary operations-Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems

### Unit-V

**Graphs** -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix representation of graphs

**Text books:**

1. N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

**Reference Books:**

* + - 1. Kimmo Eriksson & Hillevi Gavel, Discrete Mathematics & Discrete Models, Studentlitteratur AB, 2015.
			2. Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill, 2012

**Course Outcomes**

On the successful completion of the course, students will be able

| CO1: | To understand the concepts of relations and functions distinguish among normal forms | K2 | IO |
| --- | --- | --- | --- |
| CO2: | To analyze and evaluate the recurrence relations  | K4,K5 | HO |
| CO3: | To distinguish among various normal forms and predicate calculus |  K5 | HO |
| CO4: | To solve and know various types of matrices | K1 | LO |
| CO5: | To evaluate and solve various types of graphs | K5 | HO |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I****PART-A****CORE-II** | **23PMCAC12: LINUX AND SHELL PROGRAMMING** | **Credit:5****Hours:7** |

**Course Objectives**

* To teach principles of operating system including File handling utilities, Basic Linux commands, Scripts and filters.
* To familiarize fundamentals of shell (bash), shell programming, pipes, Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
* To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API’s).
* To facilitate students in understanding Inter process communication, semaphore and shared memory.
* To explore real-time problem solution skills in Shell programming.

**Unit-I**

**Basic bash Shell Commands:** Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. **Basic Script Building:** Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. **Using Structured Commands:** Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

(Book-1, Chapters: 3, 11, and 12)

**Unit-II**

**More Structured Commands:** Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

(Book-1, Chapters: 13, 14, and 16)

**Unit-III**

**Creating Functions:** Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

(Book-1, Chapters: 17, 18, and 19)

**Unit-IV**

**Regular Expressions:** Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. **Advanced sed:** Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. **Advanced gawk:** Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

(Book-1, Chapters: 20, 21, and 22)

**Unit-V**

**Working with Alternative Shells:** Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh. **Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

 (Book-1, Chapters: 23, 24, 25, and Book-2, Chapter: 14)

**Text books:**

1. Richard Blum, Christine Bresnahan, “Linux Command Line and Shell Scripting BIBLE”, Wiley Publishing, 3rd Edition, 2015.**Chapters:** 3, 11 to 14, 16 to 25.
2. Mokhtar Ebrahim, Andrew Mallett, “Mastering Linux Shell Scripting”, Packt Publishing, 2nd Edition, 2018. **Chapter:** 14.

**Reference Books:**

1. ClifFlynt, ‎Sarath Lakshman,‎ ShantanuTushar, “Linux Shell Scripting Cookbook ”, Packt Publishing, 3rd Edition, 2017.
2. Stephen G.Kochan, Patrick Wood, “Shell Programming in Unix, Linux, and OS X”, Addison Wesley Professional, 4th Edition, 2016.
3. Robert Love, “Linux System Programming”, O'Reilly Media, Inc, 2013
4. W.R. Stevens, “Advanced Programming in the UNIX environment”, 2nd Edition, Pearson Education, 2013
5. Graham Glass, King Ables, “ UNIX for Programmers and Users”, 3rd Edition, Pearson Education, 2003

**Course Outcomes**

On the successful completion of the course, students will be able

| CO1: | To understand, apply and analyze the concepts and methodology of Linux shell programming | K1-K6 |
| --- | --- | --- |
| CO2: | To comprehend, impart and apply fundamentals of control structure and script controls | K1-K6 |
| CO3: | To understand, analyses and evaluate the functions, graphical desktop interface and editors  | K1-K6 |
| CO4: | To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk | K1-K6 |
| CO5: | To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python | K1-K6 |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | S | S | S | - | S | L | - | M | M | M |
| CO2 | S | S | M | - | S | L | - | M | M | M |
| CO3 | S | S | M | - | S | L | - | M | M | S |
| CO4 | S | S | M | - | S | L | - | M | M | M |
| CO5 | S | S | M | - | S | L | - | M | M | M |

**S- Strong; M-Medium; L-Low**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I****PART-A****CORE-III** | 23PMCAC13: ADVANCED JAVA PROGRAMMING  | **Credit:5****Hours:7** |

**Course Objectives**

* To gain knowledge of Object Oriented Programming Concept in Java
* To understand usages of String functions in Java
* To familiarize with the applet and swing
* To grasp the concepts on Java Beans
* To comprehend the connection between Relational Database and Java.

**Unit – I**

An Overview of Java: Object Oriented Programming- Data Types, Variables, and Arrays: Primitive Types-Literals Variables - Type Conversion and Casting- Arrays-Operators: Control Statements-Classes and Methods – Inheritance- Exception Handling.

**Unit – II**

String Handling: The String Constructors - String Length - Special String Operations - Character Extraction - String Comparison - Searching Strings - Modifying a String - Input/Output: The I/O Classes and Interfaces – File - Byte Streams - Character Streams.

**Unit – III**

The Applet Class: Basic Architecture - Applet Skeleton - Display methods - Status Window – Passing Parameters. Introducing GUI Programming with Swing– Introducing Swing - Swing Is Built on the AWT- Two Key Swing Features - The MVC Connection - Components and Containers - The Swing Packages - A Simple Swing Application - Exploring Swing.

**Unit- IV**

Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API - A Bean Example. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies session tracking.

**Unit – V**

Network Programming: Working with URLs- Working with Sockets - Remote Method Invocation. Introduction to Database Management Systems - Tables, Rows, and Columns - Introduction to the SQL SELECT Statement - Inserting Rows - Updating and Deleting Existing Rows - Creating and Deleting Tables - Creating a New Database with JDBC - Scrollable Result Sets.

**Text Books:**

1. Herbert Schildt, “Java the Complete Reference”, 10th edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2. Tony Goddis, “Starting out with Java from Control Structures Through Objects” 6th Edition, Pearson Education Limited, 2016

**Reference Books:**

1. Herbert Schildt, Dale Skrien, “Java Fundamentals – A Comprehensive Introduction”, TMGH Publishing Company Ltd, New Delhi, 2013
2. John Dean, Raymond Dean, “Introduction to Programming with JAVA – A Problem Solving Approach”, TMGH Publishing Company Ltd, New Delhi,2012.

**Course Outcomes:**

On the successful completion of the course, students will be able

| CO1: | Understand the Object Oriented Program including classes and methods; inheritance and exception handling | K1-K6 |
| --- | --- | --- |
| CO2: | Complete comprehension of String functions and I/O Streams |  K1-K6 |
| CO3: | Creation of graphical representation using Applet | K1-K6 |
| CO4: | Application of Servlets for designing Web based applications  | K1- K6 |
| CO5: | Usage of JDBC connectivity and implementation of the concept to get desired results from database | K1-K6 |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | S | S | S |  - | M  | S  |  - | -  | -  | S  |
| CO2 | S | S | S |  - |  M |  S |  - |  - |  - |  L |
| CO3 | S | S | M |  - | L |  S |  - |  - |  - |  M |
| CO4 | M | S | M | - | S | S | - | - | - | M |
| CO5 | S | M | M | - | M | L | - | - | - | M |

**S- Strong; M-Medium; L-Low**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I****PART-A****ELECTIVE-I** | 23PMCAE14-1:DATA ENGINEERING AND MANAGEMENT LAB (Practical) | **Credit:3****Hours:5** |

**Course Objectives:**

* To acquire basic scripting knowledge in MongoDB
* To learn CRUD Operation on MongoDB database
* To comprehend MongoDB using Db Visualizer
* To be familiar with Zoho CRM features
* To customize your application using Zoho CRM

**Exercises:**

1. Write a script to create a MongoDB database and perform insert operation
2. Write a MongoDB script to perform query operations
3. Write a MongoDB Script to perform update operations
4. Write a MongoDB Script to update documents with aggregation pipeline
5. Write a MongoDB script to delete single and multiple documents
6. Write a MongoDB script to perform string aggregation operations
7. Design a Data Model for MongoDB using Db Visualizer
8. Perform CRUD operations using Db Visualizer
9. Create a Zoho CRM account and organize your Tasks, Meetings and Deals
10. Create and maintain a project using Zoho CRM features

 **Course Outcomes:**

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

| **Course Outcome** | **Description** | **Knowledge Level** |
| --- | --- | --- |
| **CO1** | Comprehend the scripting knowledge in MongoDB and perform basic operations in shell prompt | **K1- K6** |
| **CO2** | Implement, Create, Read, Update and Delete Operations on MongoDB database |
| **CO3** | Analyze MongoDB using Db Visualizer |
| **CO4** | Assess Zoho CRM features for managing the customer relationships |
| **CO5** | Create a customized application in Zoho CRM |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6-Create**

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | S | S | S | M | S | S | S | M |
| **CO2** | S | S | S | S | S | S | S | S | S | S |
| **CO3** | S | M | S | S | M | S | M | S | S | S |
| **CO4** | S | S | S | M | S | S | S | L | S | S |
| **CO5** | S | S | S | S | M | S | S | S | S | S |

**S- Strong; M-Medium; L-Low**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I****PART-A****ELECTIVE-I** | 23PMCAE14-2: HIGH PERFORMANCE COMPUTING LAB (PRACTICAL) | **Credit:3****Hours:5** |

**Course Objectives:**

* To understand concepts of High Performance Computing.
* To get brief knowledge about PB and Slurm.
* To understand techniques of Open MP and Open MPI.
* To understand Parallel computing concepts.
* To get familiar with CUDA.

(Implemented either PB, Slurm, Open MP, OpenMPI, and CUDA)

1. Demo: - Access and best practices on HPC
2. Matrix multiplication with Job scheduling (PB or Slurm)
3. Vectors add with malloc shared
4. Vector add program with MPI
5. Hello world task for Multithreading with open MP
6. Open MP shared memory on Host and Device
7. Open MP Matrix Multiplication with parallelism and Barrier
8. Open MP with Reduction on operands and aggregate functionality
9. Vector and Matrix multiplication on CUDA
10. Feed forward computing on CUDA

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I****PART-A****ELECTIVE-II** | 23PMCAE15-1: DOT NET TECHNOLOGIES LAB (PRACTICAL) | **Credit:3****Hours:5** |

**Course Objectives:**

* To get strong understanding of .NET Framework and C# programming.
* To get advanced programming skills in C# .NET OOPs Concepts
* To get advanced methods of manipulating data using Microsoft SQL Server.
* To get clear idea of how to developing real-time standalone, web applications using ASP .NET.
* To get clear understanding and get experience in Microsoft Azure.

**Implement the following problems using C# with Visual Studio 2017**

1. Demonstrate method overloading and method overriding
2. Class and Objects
3. Multilevel Inheritance
4. Interfaces
5. Demonstrate multiple type of Exceptions
6. Azure Storage Container Using the Microsoft Azure Storage Client Library
7. Demonstrate Read and Write a Data using Random Access Files
8. Employee management database using LINQ
9. Student management system using ASP.NET
10. Demonstrates simple Universal App.

 **Course Outcomes:**

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

|  |  |  |  |
| --- | --- | --- | --- |
| **CO1** | Get a strong understanding of .NET Visual Studio platform | **K1, K2** | **LO** |
| **CO2** | Become a strong knowledge in C# .NET | **K3** | **IO** |
| **CO3** | Getting real-time application developing using .NET Cloud Technologies. | **K4,K5** | **HO** |

**K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create**

**Mapping with Programme Outcomes:**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | L | M | L | L | L | - | - | - | - |
| **CO2** | S | M | L | M | M | L | - | L | - | L |
| **CO3** | S | S | S | M | M | L | - | L | - | L |

* **L - Low, M- Medium, S – Strong**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I****PART-A****ELECTIVE-II** | 23PMCAE15-2: ARCHITECTURE AND FRAMEWORKS – LAB (PRACTICAL) | **Credit:3****Hours:5** |

**Course Objectives:**

* To understand and implement the basic concepts of Software architecture and its functions.
* To acquire programming skills to develop Implement various technologies and services associated with network protocols along with the challenges of data transfer.
* Implement the importance and functioning of Routing Protocols over communication service.
* To acquire skills to connect two routers and any two switches.
* To comprehend related to SSH protocols and accessing the remote device.

Note: Use the solid servers and client specification for implementation

https://github.com/solid/specification/.

**Implement the following using Linux / Windows environments**

1. Find the Web ID profile document and display the necessary attributes
2. Set and access the primary authentications with account recovery mechanisms
3. Set and access the secondary authentications with account recovery mechanisms
4. Design authorization and web access control
5. Find the content representation
6. Reading resources from HTTP REST API and Web Sockets API
7. Writing resources from HTTP REST API and Web Sockets API
8. Data notification using Social Web App protocol
9. Managing subscriptions and friends list using Social Web App protocol
10. Managing list of followers and following list using Social Web App protocol

**Course Outcomes:**

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

| CO1 | Comprehend the programming skills of Software architecture tools and packages | K1-K6 |
| --- | --- | --- |
| CO2 | Understand and implement the user profiles and authentication with recovery mechanism.  | K1-K6 |
| CO3 | Comprehend and evaluate the access control and content representation use of FTP server | K1-K6 |
| CO4 |  Understand and implement reading and writing resources for various applications | K1-K6 |
| CO5 |  Identify and examine the notifications, friends, and follower list of social application protocols. | K1-K6 |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create**

**Mapping Course outcomes with Programme outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 |
| --- | --- | --- | --- | --- | --- |
| CO1 | S | S | M | L | M |
| CO2 | S | M | S | S | S |
| CO3 | S | M | S | M | S |
| CO4 | S | M | L | S | M |
| CO5 | M | S | M | L | S |

**S- Strong; M-Medium; L-Low**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: II****PART-A****CORE-IV** | **23PMCAC21: DATA STRUCTURES AND**  **ALGORITHMS** | **Credit:5****Hours:6** |

**Course Objectives:**

* To get a clear understanding of various ADT structures.
* To understand how to implement different ADT structures with real-time scenarios.
* To analyze the various data structures with their different implementations.
* To get an idea of applying right models based on the problem domain.
* To realize, and understand how and where to implement modern data structures with Python language.

**Unit-I**

**Abstract Data Types:** Introduction-Date Abstract Data Type-Bags-Iterators. **Arrays**: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. **Sets, Maps:** Sets-Maps- Multi-Dimensional Arrays.

**Unit-II**

**Algorithm Analysis:** Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

**Unit-III**

**Stacks, Queues, and Deques:** Stacks- Queues- Double-Ended Queues Linked. **Lists:** Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. **Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

**Unit-IV**

**Priority Queues:** Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. **Maps, Hash Tables, and Skip Lists:** Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

**Unit-V**

**Search Trees:** Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. **Sorting and Selection:** Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. **Graph Algorithms:** Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.

**Text books:**

1. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011. (Unit – 1)**Chapters:** 1, 2, 3.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5)**Chapters:** 3 to 12, and 14.

**Reference Books:**

1. Dr. Basant Agarwal; Benjamin Baka, “Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7”, Packt Publishing, 2018.
2. Magnus Lie Hetland, “Python Algorithms: Mastering Basic Algorithms in the Python Language”, Apress, 2014.

**Course Outcomes:**

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

| CO1 | Understand various ADT concepts | K1-K6 |
| --- | --- | --- |
| CO2 | Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems |
| CO3 | Apply with proper ADT models with problem understanding |
| CO4 | Apply and Analyze right models based on the problem domain |
| CO5 | Evaluate modern data structures with Python language |

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

**Mapping with Programme Outcomes:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | S | M | L | L | L | L | S | S | S | L |
| CO2 | S | M | S | M | M | L | L | L | L | L |
| CO3 | S | S | S | L | L | L | M | M | M | M |
| CO4 | S | S | S | L | L | L | M | M | M | L |
| CO5 | S | S | S | L | M | M | S | S | S | S |

**L - Low, M- Medium, S - Strong**

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| --- | --- | --- |
| **SEMESTER: II****PART-A****CORE-V** | **23PMCAC22: ADVANCED COMPUTER NETWORK**  | **Credit:5****Hours:6** |

**Course Objectives:**

* Study the advanced concepts of the computer networking and enumerate the layers and TCP/IP model.
* Acquire knowledge of Wireless communication and Data link layer.
* Understand the datalinks and protocols.
* Gain core knowledge of Network layer routing protocols and IP addressing.
* Study the transport layer and network security

**Unit 1 - Introduction –** Network Hardware – Software – Reference Models – OSI and TCP/IP models – Example networks: Internet, 3G Mobile phone networks, Wireless LANs –RFID and sensor networks - Physical layer – Theoretical basis for data communication - guided transmission media

**Unit-2-Wireless transmission** – Communication Satellites–Digital modulation and multiplexing - Telephones network structure – local loop, trunks and multiplexing, switching. Data link layer: Design issues–error detection and correction.

**Unit 3-Elementary data link protocols**- sliding window protocols – Example Data Link protocols–Packet over SONET, ADSL-Medium Access Layer–Channel Allocation Problem–Multiple Access Protocols.

**Unit 4-Network layer**- design issues - Routing algorithms - Congestion control algorithms –Quality of Service – Network layer of Internet- IP protocol – IP Address – Internet Control Protocol.

**Unit 5-Transport layer** – transport service- Elements of transport protocol - Addressing, Establishing & Releasing a connection – Error control, flow control, multiplexing and crash recovery- Internet Transport Protocol–TCP- Network Security: Cryptography.

## Text Books:

1.Andrew S Tanenbaum(2018),“ComputerNetworks”,LowpriceEdition,FourthEdition.

## Reference Books:

1. Teresa C. Piliouras (2015), “Network Design Management and Technical Perspectives”, Auerbach Publishers, Second Edition.
2. https:// [www.pdfdrive.com/ advanced-computing-networking- and-informatics- volume-1-](http://www.pdfdrive.com/%20advanced-computing-networking-%20and-informatics-%20volume-1-)advanced- computing- and- informatics- proceedings- of-the-second-international-conference-on-advanced-computing - networking- and- informatics- icacni- 2014-e174550006 .html

**Course Outcomes (COs):**

At the end of the course, the student will be able to

|  |  |
| --- | --- |
| **CO1** | Understand the terminology and concepts of the OSI reference model |
| **CO2** | Student will get the knowledge of protocols, network interfaces, and design issues in local area networks and wide area networks. |
| **CO3** | Understand wireless networking concepts, and be familiar with contemporary issues in networking technologies. |
| **CO4** | Gain knowledge the network tools and network programming. |
| **CO5** | Understand the Establishing and Releasing a connection in transport layer. |

## Outcome Mapping:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** |  |  | S |  | M | S |  |  | M | M |
| **CO2** |  |  |  | L | S | M |  | S |  | M |
| **CO3** | S |  |  | S |  | S |  | M |  | L |
| **CO4** | S |  | S | M | M | S |  | L |  | S |
| **CO5** |  | S |  |  |  |  | S |  | M |  |

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| --- | --- | --- |
| **SEMESTER: II****PART-A****CORE PRACTICAL-VI** | **23PMCAP23 : DATA STRUCTURES AND**  **ALGORITHMS LAB** | **Credit:4****Hours:6** |

**Course Objectives:**

* To understand Stack, Queue and Doubly Linked ADT structures.
* To implement different ADT structures with real-time scenarios.
* To analyze the recursion concepts.
* To apply different sorting and tree techniques.
* To implement modern data structures with Python language.

**Implement the following problems using Python 3.4 and above**

1. Recursion concepts.
2. Linear recursion
3. Binary recursion.
4. Stack ADT.
5. Queue ADT.
6. Doubly Linked List ADT.
7. Heaps using Priority Queues.
8. Merge sort.
9. Quick sort.
10. Binary Search Tree.
11. Minimum Spanning Tree.
12. Depth First Search Tree traversal.

**Course Outcomes:**

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

| CO1 | Strong understanding in various ADT concepts | K1-K6 |
| --- | --- | --- |
| CO2 | To become a familiar with implementation of ADT models  |
| CO3 | Apply sort and tree search algorithms |
| CO4 | Evaluate the different data structure models |
| CO5 | Learn how to develop ADT for the various real-time problems |

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

**Mapping with Programme Outcomes:**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | M | L | L | L | L | S | S | M | M |
| **CO2** | S | M | S | M | M | L | S | M | S | L |
| **CO3** | S | S | S | L | L | L | M | M | M | M |
| **CO4** | S | S | S | M | M | S | M | M | S | S |
| **CO5** | S | S | S | S | L | M | S | M | M | M |

**L - Low, M- Medium, S – Strong**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: II****PART-A****ELECTIVE-III** | **23PMCAE24-1: CRYPTOGRAPHY AND NETWORK SECURITY LAB****(PRACTICAL)** | **Credit:3****Hours:4** |

**Course Objective**

* To develop in classical encryption techniques and advanced encryption standards.
* To acquire programming skills in Implement various cryptographic algorithms including secret key cryptography.
* To develop hashes, message digests and public key algorithms.
* Implement different encryption and decryption techniques.
* To comprehend related to confidentiality and authentication techniques.

**Implement the following**

1. Write a program that contains a string (char pointer) with a value ‘Hello world’. The program should XOR each character in the string with 0 and display the result
2. Write a program to perform encryption and decryption using the Ceaser Cipher
3. Write a program to perform encryption and decryption using the Hill Cipher
4. Write a program to perform encryption and decryption using the Substitution Cipher
5. Write a program to perform encryption and decryption using the DES algorithm
6. Connect to switch with a computer and enable the port security
7. Defeating malware using Building Trojans and Rootkit hunter
8. Implement signature scheme – Digital Signature Standard
9. Identify and capture the user name and password in a same network using wires hark
10. Implement Man-in-the-middle attack and Session hijacking

**Course Outcomes:**

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

| CO1 | Comprehend the programming skills in classical encryption techniques and to develop advanced encryption standards | K1-K6 |
| --- | --- | --- |
| CO2 | Understand and implement the various cryptographic algorithms including secret key cryptography, hashes and message digests | K1-K6 |
| CO3 | Evaluate the use of different encryption and decryption techniques | K1-K6 |
| CO4 | Design to Solve related confidentiality and authentication problems | K1-K6 |
| CO5 | Create public key algorithms | K1-K6 |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create**

**Mapping Course outcomes with Programme outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | S | - | - | - | - | L | - | - | - | - |
| CO2 | S | - | M | - | M | L | - | - | - | - |
| CO3 | S | - | S | - | S | L | - | - | - | S |
| CO4 | S | - | S | - | S | L | - | - | - | S |
| CO5 | S | - | S | - | S | L | - | - | - | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: II****PART-A****ELECTIVE-III** | **23PMCAE24-2 : NETWORK PROTOCOLS LAB****(PRACTICAL)** | **Credit:3****Hours:4** |

**Course Objectives:**

* To understand and implement the basic concepts of Transmission Control Protocol/Internet Protocol and associated functions.
* To acquire programming skills in Implement various technologies and services associated with network protocols along with the challenges of data transfer.
* Implement the importance and functioning of Routing Protocols over communication service.
* To acquire skills to connect two routers and any two switches.
* To comprehend related to SSH protocols and accessing the remote device.

**Implement the following using Linux / Windows environments**

1. Implement the following commands
	1. ipconfig
	2. ping
	3. traceroute
	4. netsat
	5. nslookup
2. Implement the following server commands
	1. ifconfig
	2. ip
	3. tracepath
	4. ss
	5. tcpdum
3. Connect and place the given file in the FTP server
4. Install packet tracer and connect a computer to router, switch and get a Icmp request
5. Implement the SSH protocols and accessing the remote device
6. Connect any two switches and get the status of each switches
7. Connect two routers and get packets from the routers.
8. Get the access of the router by connecting with working computer
9. Identify the route password of server and get the connection using telnet
10. Install wire shark for capture and analyse the packets (TCP /UDP)

**Course Outcomes:**

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

| **CO1:** | Comprehend the programming skills the SSH protocols and accessing the remote device  | **K1-K6** |
| --- | --- | --- |
| **CO2:** | Understand and implement the various functioning of Routing Protocols over communication service.  | **K1-K6** |
| **CO3:** | Evaluate the use of FTP server | **K1-K6** |
| **CO4:** | Design to Connect any two switches and get the status of each switches | **K1-K6** |
| **CO5:** | Solve to Connect two routers and get packets from the routers. | **K1-K6** |

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5-Evaluate, K6- Create**

**Mapping Course outcomes with Programme Outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | - | - | - | - | L | - | - | - | - |
| **CO2** | S | - | M | - | M | L | - | - | - | - |
| **CO3** | S | - | S | - | S | L | - | - | - | S |
| **CO4** | S | - | S | - | S | L | - | - | - | S |
| **CO5** | S | - | S | - | S | L | - | - | - | S |

**S- Strong; M-Medium; L-Low**

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| **SEMESTER: II****PART-A****ELECTIVE-IV** | **23PMCAE25-1: Computer Vision Lab** **(Practical)** | **Credit:3****Hours:4** |

**Course Objectives:**

* To get an idea of how to build a computer vision application with Python language.
* To learn the basic image handling and processing
* To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
* To get an idea of how to implement the image transforms.
* To understand various image segmentation algorithms.

**Implement the following problems using Python with Open CV**

1. Image Loading, Exploring, and displaying an Image.
2. Access and Manipulate of Image Pixels.
3. Image Transformations.
4. Resizing
5. Rotation
6. Addition operation of Two Images.
7. Image filtering operations
8. Mean Filtering
9. Gaussian Filtering
10. Image Binarization Using Simple Thresholding method.
11. Edge Detection operation using Sobel and Scharr Gradients.
12. Find Grayscale and RGB Histograms of an Image.
13. Segment an Image using K-means Clustering algorithm.
14. Write a program to classify an Image using KNN Classification algorithm.

**Course Outcomes:**

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

|  |  |  |
| --- | --- | --- |
| **CO1** | To develop and implement the image loading and exploring | **K1-K6** |
| **CO2** | To Evaluate the image transforms |
| **CO3** | To apply and analyze for image processing denoising algorithms |
| **CO4** | To design and develop the Image Segmentation using Edge detection and Histograms |
| **CO5** | To apply and analyze image clustering and classification algorithms |

**K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create**

**Mapping with Programme Outcomes:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | S | L | M | L | L | L | M | M | M | S |
| CO2 | S | M | L | M | M | L | S | L | S | L |
| CO3 | S | S | S | M | M | L | M | L | M | L |
| CO4 | S | S | S | M | M | L | M | L | M | L |
| CO5 | S | S | S | M | M | L | S | L | S | L |

**L - Low, M- Medium, S - Strong**

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| --- | --- | --- |
| **SEMESTER: II****PART-A****ELECTIVE-IV** | **23PMCAE25-2: SOLUTION ARCHITECTURE LAB** **(PRACTICAL)** | **Credit:3****Hours:4** |

**Course Objectives:**

* To get familiar with AWS cloud services
* To design secure, scalable, and well structured cloud solutions
* To create EC2 instance and configure options
* To connect EC2 with Linux instance
* To connect VPN server to securely access instances

**Implement the following problems:**

1. Managing Virtual Private Cloud
2. Creating and Configuring Internet Gateways
3. Configuring Routing Tables
4. Working with Amazon Elastic Cloud Compute (EC2)
5. Connecting EC2 Linux instance using PuTTY, Gitbash and Console
6. Recovering and connecting EC2 instance if the SSH key is lost
7. Creating and Configuring Elastic Load Balancer
8. Scheduling Auto Snapshot of volumes
9. Configuring Centralized Log Management using Cloud Watch Log
10. Connecting Open VPN server

**Course Outcomes:**

**On the successful completion of the course, students will be able to**

|  |  |  |
| --- | --- | --- |
| **CO1:** | Understand AWS cloud services and manage the cloud data | **K1- K6** |
| **CO2:** | Develop secure, scalable, and well structured cloud solutions |
| **CO3:** | Implement EC2 instance and configure the instance |
| **CO4:** | Connect EC2 with Linux instance and perform operations |
| **CO5:** | To connect VPN server to access instances with more security |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | S | S | S | S | S | S | S | M |
| **CO2** | S | S | S | S | S | S | S | S | S | S |
| **CO3** | S | M | S | S | S | S | M | S | S | S |
| **CO4** | S | S | S | M | S | S | S | S | S | S |
| **CO5** | S | S | S | S | M | S | S | S | S | M |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: II****PART-B****Skill Enhancement Course [SEC]-I** | **SKILL ENHANCEMENT COURSE [SEC]-I****23PMCAS26: SOFTWARE DEVELOPMENT TECHNOLOGIES** | **Credit:2****Hours:4** |

**Course Objectives:**

* To learn and Implementing Micro services
* To analysing the Azure Kubernetes Service
* To learn and anlyse .NET DevOps for Azure and its applications
* To building code for .NET core applications
* To get familiarized with Azure pipelines

**Unit -I**

**Implementing Microservices :** Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options. Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric. Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service Using Application Insights, Cluster monitoring, Infrastructure monitoring.

**Unit-II**

**Azure Kubernetes Service (AKS) :** Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native kubernetes dashboard, Prometheus and Grafana. Securing Microservices: Authentication in microservices, Implenting security using API gateway pattern, Creating application using Ocrlot and securing APIs with Azure AD. Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges. Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack.

**Unit-III**

**.NET DevOps for Azure:** DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure.

**Unit-IV**

**Building the code:** Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection. Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for release candidates, Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.

**Unit-V**

**Introduction to APIs:** Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management. API Development: Considerations, Standards, kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization.

**Text Books:**

1. Harsh Chawla and Hemant Kathuria, Building Microservices Applications on Microsoft Azure- Designing, Developing, Deploying, and Monitoring, Apress, 2019.
2. Jeffrey Palermo , NET DevOps for Azure A Developer’s Guide to DevOps Architecture the Right Way, Apress, 2019.
3. Thurupathan and Vijayakumar, Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud, Apress, 2018.

**Reference Books:**

1. Karl Matthias and Sean P. Kane, Docker: Up and Running, O'Reilly Publication, Second Edition 2018.
2. Len Bass, Ingo Weber, Liming Zhu,” DevOps, A Software Architects Perspective”, Addison Wesley-Pearson Publication, First Edition 2015.
3. John Ferguson Smart, ”Jenkins, The Definitive Guide”, O'Reilly Publication, First Ediiton 2011.

**Course Outcomes:**

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

| CO1: | To understand, apply and summarize the basic concepts of  Micro services communication Microsoft Azure and Dev Ops for software development life cycle | K1-K6 |
| --- | --- | --- |
| CO2: | To illustrate, and implement Azure Kubernetes Service tools for software development life cycle | K1-K6 |
| CO3: | To recognize, analyses and summarize the functionalities of .NET Dev Ops for Azure applications | K1-K6 |
| CO4: | To understand, design and evaluate the principles and architecture service tools for software development life cycle. | K1-K6 |
| CO5: | To comprehend, implement and review the functionalities of API and API gateways for cloud and Azure applications | K1-K6 |

 **K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | M | - | M | - | - | - | S | - |
| **CO2** | S | S | M | - | M | - | - | - | S | - |
| **CO3** | S | S | S | - | S | - | - | - | S | S |
| **CO4** | S | S | M | - | M | - | - | - | S | - |
| **CO5** | S | S | M | - | M | - | - | - | S | - |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-A****CORE-VII** | 23PMCAC31: PYTHON PROGRAMMING | **Credit:5****Hours:6** |

**Course Objectives:**

* To acquire programming skills in core Python
* To learn Strings and function
* To develop object oriented skills in Python
* To comprehend various Python Packages
* To develop web applications using Django

**UNIT I**

Introduction : Fundamental ideas of Computer Science **-** Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop

**UNIT II**

Strings and Text Files: Accessing Characters and substrings in strings - Data encryption-Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program’s namespace - Higher-Order Functions

**UNIT III**

Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism – Graphical User Interfaces - The Behavior of terminal - Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events

**UNIT IV**

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The Data Frame - The Index Objects – Data Vizualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts

**UNIT V**

Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with QuerySets and Managers – Retrieving Objects – Building List and Detail Views

**Text Book:**

1. K.A. Lambert, “ Fundamentals of Python: first programs”, Second Edition, Cengage Learning, 2018 **(Unit - I, II and III)**

**Reference Books :**

1. [Fabio Nelli](https://www.amazon.in/s/ref%3Ddp_byline_sr_ebooks_1?ie=UTF8&field-author=Fabio+Nelli&text=Fabio+Nelli&sort=relevancerank&search-alias=digital-text), “Python Data Analytics: With Pandas, NumPy, and Matplotlib”,  Second Edition, Kindle Edition, 2018 **(Unit - IV)**

1. Antonio Mele, “Django 3 By Example”, Third Edition, 2020 **(Unit - V)**

**Course Outcomes**

**On the successful completion of the course, students will be able to**

|  |  |  |
| --- | --- | --- |
| **CO1** | Comprehend the programming skills in python and develop applications using conditional branches and loop | **K1- K6** |
| **CO2** | Create python applications with strings and functions |
| **CO3** | Understand and implement the Object Oriented Programming paradigm with the concept of objects and classes, Inheritance and polymorphism |
| **CO4** | Evaluate the use of Python packages to perform numerical computations and data vizualization |
| **CO5** | Design interactive web applications using Django |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | M | S | M | S | S | S | S | M |
| **CO2** | S | S | S | M | S | S | S | S | S | S |
| **CO3** | S | M | S | S | M | S | M | S | S | M |
| **CO4** | S | S | S | S | S | S | S | M | S | S |
| **CO5** | S | S | S | S | S | S | S | S | S | M |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-A****CORE-VIII** | 23PMCAC32: WEB TECHNOLOGY  | **Credit:5****Hours:6** |

**Course Objectives:**

* Understand the fundamentals of the web and thereby develop web applications using various development languages and tools.
* Enrich knowledge about XHTML control and Cascading Style Sheets.
* Provide in- depth knowledge about Javascript.
* To enhance knowledge in XML documents with presentations using CSS and XSLT.
* Deliver depth knowledge about PHP, Angular JS, Jquery.

**UNIT -I**

**WEB FUNDAMENTALS AND HTML:** A Brief Introduction to the Internet - The World Wide Web -   Web Browsers - Web Servers -URLs, MIME, HTTP, Security- Introduction to HTML- Origins and Evolution of HTML and HTML -   Basic Syntax - Standard HTML Document Structure - Basic Text Markup - Images- Hypertext Links - Lists, Tables, Forms, The Audio Element, The Video Element - Organization Elements, The Time Element

**UNIT – II**

**INTRODUCTION TO XHTML AND CSS:** Basic syntax, Standard structure, Basic text-markup, Images, Hypertext Links. Lists, Tables, Forms, Frames, syntactic differences between HTML and XHTML-Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The<span> and <div>tags, Conflict resolution.

**UNIT - III**

THE BASICS OF JAVASCRIPT: Overview of JavaScript, Object orientation and JavaScript, general Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts.

**JAVASCRIPT AND XHTML DOCUMENTS**: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Model

**UNIT- IV**

DYNAMIC DOCUMENTS WITH JAVASCRIPT AND XML: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Color and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements. Introduction to XML, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT Style Sheets, Web services.

**UNIT - V**

**PHP, ANGULAR JS AND JQUERY:**  Introduction to PHP:   Overview of PHP -General Syntactic Characteristics -    Primitives, Operations, and Expressions - Output - Control Statements -   Arrays -   Functions - Pattern Matching -   Form Handling -       Cookies - Session Tracking - Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS. Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations, Examples.

**Text Books:**

1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. **UNITS:** 1,2,3,4
2. [Dayley Brad](https://www.amazon.in/s/ref%3Ddp_byline_sr_ebooks_1?ie=UTF8&field-author=Dayley+Brad&text=Dayley+Brad&sort=relevancerank&search-alias=digital-text), [Dayley Brendan](https://www.amazon.in/s/ref%3Ddp_byline_sr_ebooks_2?ie=UTF8&field-author=Dayley+Brendan&text=Dayley+Brendan&sort=relevancerank&search-alias=digital-text) ,”AngularJS, JavaScript, and jQuery All in One”, Sams Teach Yourself 1st Edition, Kindle Edition, 2015.**UNIT**: 5

**Reference Books:**

1. M. Srinivasan: Web Programming Building Internet Applications, 3rdEdition, Wiley India, 2009.
2. Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7thImpression,2012.
3. Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4. Raj Kamal: Internet and Web Technologies, McGraw Hill Education.

**Course Outcomes:**

 On the successful completion of the course, students will be able

| CO1 | Design dynamic web pages using Javascript, Jquery and Angular Java script | K1 | LO |
| --- | --- | --- | --- |
| CO2 | Develop Web pages using HTML, CSS and XML | K2 | IO |
| CO3 | Create web application using PHP and MySQL | K3, K4 | HO |
| CO4 | To design dynamic web pages using Angular javascript | K2,K3 | HO |
| CO5 | Develop interactive web pages using Jquery | K4,K5 | HO |

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | M | S | S | S | S | M | M | S | M | M |
| **CO2** | S | S | M | S | S | S | M | S | S | S |
| **CO3** | S | S | S | M | S | S | M | M | S | M |
| **CO4** | S | S | S | M | S | M | M | S | S | M |
| **CO5** | S | S | S | M | S | S | M | S | M | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-A****CORE-IX** | 23PMCAC33: ADVANCED MACHINE LEARNING TECHNIQUES | **Credit:5****Hours:6** |

**Course Objectives**

* To understand the concepts of Machine Learning.
* To understand the theoretical and practical aspects of types of machine learning
* To teach and get familiarized with supervised learning and their applications.
* To teach and get familiarized with the concepts and algorithms of unsupervised learning.
* To appreciate the concepts and algorithms of deep learning.

**UNIT I:**

**Introducing Machine Learning**: The Origins of Machine Learning, Uses and Abuses of Machine Learning \_ Basics of Machine Learning Algorithm Model Works - Steps to apply Machine Learning - Choosing a Machine Learning Algorithm - Using Machine Learning concepts.

**Managing and Understanding Data:** Data Structures, Vectors And Factors: Lists, Data frames, Matrixes and arrays - Managing Data - Exploring and Understanding Data: Exploring the Structure of Data, Exploring Numeric variables - Exploring Categorical Variables- Exploring Relationships between Variables.

**Unit II:**

Lazy Learning – C**lassification Using Nearest Neighbors:** The kNN Algorithm- Diagnosing Breast Cancer with the kNN Algorithm- Probabilistic Learning – Classification Using Naive Bayes: Basic concepts of Bayesian Methods- The Naïve Bayes Algorithm- Example – filtering Mobile Phone Spam with the Naive Bayes Algorithm.

Divide and Conquer – **Classification Using Decision Trees and Rules:** Understanding Decision Trees- Example – Identifying Risky Bank Loans using C5.0 Decision Trees- Understanding Classification Rules- Example – Identifying Poisonous Mushrooms with Rule Learners.

**Unit III:**

Forecasting Numeric Data – **Regression Methods:** Understanding Regression- Example – Predicting Medical Expenses using Linear Regression- Understanding Regression Trees and Model Trees- Example – Estimating the Quality of Wines with Regression Trees and Model Trees.

Black Box Methods Neural Networks and Support Vector Machines: Understanding Neural Networks, from Biological to Artificial Neurons, Activation Functions, Network Topology, Training Neural Networks with Backpropagation - Modeling the Strength of Concrete with ANNs- Understanding Support Vector Machines- Performing OCR with SVMs- Finding Patterns – Market Basket Analysis Using Association Rules: Understanding Association Rules- Example – Identifying Frequently Purchased Groceries with Association Rules.

**Unit IV:**

Finding Groups of Data – **Clustering with K-Means:** Understanding Clustering- The k-means Algorithm for clustering- Finding teen market segments using k-means Clustering- Evaluating Model Performance: Measuring Performance for Classification- Beyond Accuracy – other Measures of Performance, Visualizing Performance Tradeoffs.

Improving Model Performance: Tuning Stock Models for Better Performance-Using Caret for Automated Parameter Tuning- Creating a simple Tuned Model- Customizing the Tuning Process- Improving Model Performance with meta-learning- Understanding Ensembles- Bagging- Boosting- Random forests.

**Unit V:**

**Introduction to Deep Learning:** Introduction to Deep Learning, Single Layer Perceptron Model (SLP), Multilayer Perceptron Model (MLP), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs),Restricted Boltzmann Machines (RBMs).

**Convolutional Neural Networks (CNNs):**  Structure and Properties of CNNs - Components of CNN Architectures- Convolutional Layer, Pooling Layer, Rectified Linear Units (ReLU) Layer, Fully Connected (FC) Layer, Loss Layer - Tuning Parameters ,Notable CNN Architectures, Regularization- Recurrent Neural Networks (RNNs): Fully Recurrent Networks, Training RNNs with Back-Propagation Through Time (BPPT)- Elman Neural Networks, Neural History Compressor, Long Short-Term Memory (LSTM), Traditional and Training LSTMs - Structural Damping Within RNNs, Tuning Parameter Update Algorithm.

**Text Books:**

1. Brett Lantz, “Machine Learning with R”, Addison-Wesley Packt Publishing, 2013.
2. Taweh Beysolow, “Introduction to Deep Learning Using R: A Step-by-Step Guide to Learning and Implementing Deep Learning Models Using R”, San Francisco, California, USA, 2017.

**Reference Books:**

1. Daniel T. Larose, Chantal D. Larose, “Data mining and Predictive analytics”, Second Ed., Wiley Publication, 2015.
2. Bertt Lantz, “Machine Learning with R: Expert techniques for predictive modeling”, 3rd Edition, April 15,2019,
3. Jason Bell, “Machine Learning: Hands-On for Developers and Technical Professionals”, Wiley Publication,2015.

**Course Outcomes**

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

|  |  |  |
| --- | --- | --- |
| CO1 | To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data | K1-K6 |
| CO2 | To comprehend, apply and evaluate the classification techniques for real-world applications | K1-K6 |
| CO3 | To understand, use and perform evaluation of Regression methods | K1-K6 |
| CO4 | To recognize, implement and analyse the unsupervised techniques for real-world applications | K1-K6 |
| CO5 | To understand, identify, implement and review the deep learning techniques for real-time applications | K1-K6 |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- create**

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | - | - | S | L | - | S | - | - |
| **CO2** | S | S | M | - | S | L | - | S | - | - |
| **CO3** | S | S | S | - | S | L | - | S | - | S |
| **CO4** | S | S | M | - | S | L | - | S | - | - |
| **CO5** | S | S | S | - | S | L | - | S | - | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-A****CORE-X** | 23PMCAP34: INTEGRATED TECHNOLOGY (AML) LAB | **Credit:5****Hours:6** |

**Practical:**

**Course Objectives**

* To formulate machine learning problems corresponding to different applications.
* To understand a range of machine learning algorithms along with their strengths and weaknesses.
* To apply machine learning algorithms to solve problems of moderate complexity.
* To apply CNN to solve problems of moderate complexity.
* To apply LSTM and RNN to solve problems.

**.0.0 List of Programs**

1. Write a python program to compute the Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, Standard Deviation
2. Implement a Linear Regression and Multiple Linear Regression with a Real Dataset
3. Implementation of Logistic Regression using sklearn
4. Implement a binary classification model.
5. Classification with Nearest Neighbours and Navie Baye Algorithm
6. Implementation Decision tree for classification using sklearn and its parameter tuning
7. Implement the k-means algorithm.
8. Implement an Image Classifier using CNN in Tensor Flow/Keras.
9. Implement an Auto encoder in Tensor Flow/Keras.
10. Implement a Simple LSTM using Tensor Flow/Keras.

**Course Outcomes**

**On the successful completion of the course, students will be able to**

|  |  |  |
| --- | --- | --- |
| **CO1** | To understand and implement the mathematical and statistical prospective of machine learning algorithms through python programming | **K1-K6** |
| **CO2** | To recognize and develop the machine learning models through python in built functions | **K1-K6** |
| **CO3** | To understand, impart and develop the machine learning models for real-time dataset | **K1-K6** |
| **CO4** | To comprehend , impart and implement the deep learning models for real-time applications | **K1-K6** |
| **CO5** | To identify and evaluate the performance machine learning models for real-time dataset | **K1-K6** |

 **K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | S | - | S | - | - | - | M | - |
| **CO2** | S | S | S | - | S | - | - | - | M | - |
| **CO3** | S | S | S | - | S | - | - | - | M | S |
| **CO4** | S | S | S | - | S | - | - | - | M | - |
| **CO5** | S | S | S | - | S | - | - | - | M | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-A****ELECTIVE-V** | 23PMCAE35 – 1 : MOBILE COMPUTING | **Credit:3****Hours:3** |

**Course Objective:**

* To introduce the concepts of wireless devices with signal, Antenna, Radio Frequencies, Signal Propagation.
* To introduce wireless communication and networking principles, that support connectivity to cellular networks, Wireless LAN, GSM, CDMA.
* To introduce the WAP Architecture, MANET and Routing

**Unit-I**

Introduction – Applications – History of wireless communication – A Simplified reference model - Wireless transmission – Frequencies for radio transmission – Regulations – Signals –Antennas - Signal propagation: Path loss of radio signals - Additional signal propagation effects - Multi-path propagation – Multiplexing –Modulation Chapters: 1, 2.1 to 2.6

**Unit-II**

Spread spectrum – Direct sequence spread spectrum – Frequency hopping spread spectrum – Cellular systems. Medium access control: Hidden and exposed terminals – Near and far terminals – SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, slotted Aloha, Carrier sense multiple access – Reservation TDMA – Multiple access with collision avoidance – Polling – CDMA – Spread Aloha multiple access. Chapters: 3.1 to 3.3, 3.4.1 to 3.4.4, 3.4.7 to 3.4.9, 3.5.1

**Unit-III**

GSM - Mobile services – System architecture – Radio interface – Protocols – Localization and calling – Handover – Security – New Data services. UMTS and IMT-2000 - Satellite Systems: Applications – Basics – Routing – Localization – Handover. Chapters: 3.6, 4.1.1 to 4.1.8, 4.4, 5.2 to 5.6

**Unit-IV**

Wireless LAN: Infra red vs. radio transmission – Infrastructure and ad-hoc network – IEEE 802.11 – System architecture – Protocol architecture – Physics layer – Medium access control layer – MAC management – Blue tooth. Mobile network layer: Mobile IP: Goals, assumptions and requirements – entities and terminology – packet delivery – Agent discovery – Registration – Tunneling and encapsulation Recent technologies Chapters: 7.1 to 7.3.5, 7.5, 8.1.1 to 8.1.6

**Unit-V**

WAP: Architecture – wireless datagram Protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Mobile ad-hoc networks – MANET Characteristics – Classification of MANETs, Routing of MANETs, Proactive Routing Protocol - DSDV, Reactive Routing Protocols – DSR, AODV.Chapter10.3.1 to 10.3.6 (Text Book 2- 6.1, 6.2, 6.4, 6.5, 6.6)

**Text Book**:

1. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2013.
2. KumKumGarg, “Mobile Computing Theory and Practice”, Pearson Education, 2014.

**Reference Books:**

1. Rifaat A. Dayen, “Mobile Data & Wireless LAN Technologies”, Prentice Hall, 1997.
2. Steve Mann and Scoot Schibli, “The Wireless Application Protocol”, John Wiley & Inc., 2000.

**Course Outcomes:**

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

|  |  |  |  |
| --- | --- | --- | --- |
| CO1 | Understanding the basic concepts of Mobile and Wireless Communication | K1, K2 | LO |
| CO2 | Understanding the basic concepts of Spread Spectrum.  Analyzing the concepts of Medium Access Control.  | K3 | IO |
| CO3 | Analyzing the concepts of Global System for Mobile Communication and Satellite Communications. Understanding the basic concepts of Wireless LAN  | K4 | HO |
| CO4 | Understanding the basic concepts of Wireless LAN. Evaluate the performance of Mobile Network Layer | K2, K5 | HO |
| CO5 | Understanding the basic concepts of Wireless Application Protocol and create a Moile App with real time application.  Analyzing the concepts of Routing Protocols in MANET  | K2, K4, K6 | HO |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping Course outcomes with Programme outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | L | - | - | - | - | - | - | - | - | - |
| CO2 | S | M | M | M | M | - | M | - | - | - |
| CO3 | S | M | M | M | M | - | M | - | - | L |
| CO4 | S | M | M | M | M | - | M | - | - | L |
| CO5 | S | M | M | M | M | - | M | - | - | L |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-A****ELECTIVE-V** | 23PMCAE35–2 : MOBILE COMPUTING APPLICATION DEVELOPMENT LAB | **Credit:3****Hours:3** |

**Course Objective**

* To enable the students practice the concepts of Mobile application and develop solutions for real world problems.
* Understand how to work with various mobile application development frameworks.
* Comprehend the capabilities and limitations of mobile devices.
* To get clear understanding of mobile application development with  WML /J2ME.
* To get advanced methods for mobile application that makes use of any database.

**List of programs**

1. Implement the WML tags and Image using WML/J2ME.
2. Design of simple Calculator having +, -, \* and / using WML/J2ME.
3. Design of Calendar for any given month and year using WML/J2ME.
4. Design a Timer to System Time using WML/J2ME.
5. Design of a simple game using WML/J2ME.
6. Animate an image using WML/J2ME.
7. Design a personal phone book containing the name, phone no., address, e-mail, etc
8. Browsing the Internet using a Mobile phone simulator.
9. Develop a Mobile application to view the live streaming using video view.

10. Develop a mobile application that makes use of any database.

**Course Outcomes**

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

| CO1: | Apply the knowledge of mobile application development with  WML/J2ME. | K1-K6 |
| --- | --- | --- |
| CO2: | Design real life situational problems and think creatively about solutions of them. | K1-K6 |
| CO3: | Appraise the best features Programs for creating dynamic and interactive web pages using forms. | K1-K6 |
| CO4 | Create a Mobile application to view the live streaming using video view. | K1-K6 |
| CO5 | Create a mobile application that makes use of any database. | K1-K6 |

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create**

**Mapping Course outcomes with Programme outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | - | - | - | - | L | - | - | - | - |
| **CO2** | S | - | M | - | M | L | - | - | - | - |
| **CO3** | S | - | S | - | S | L | - | - | - | S |
| **CO4** | S | - | S | - | S | L | - | - | - | S |
| **CO5** | S | - | S | - | S | L | - | - | - | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-B(i)****Skill Enhancement Course [SEC]-II** |  23PMCAS36 -1 : WEB TECHNOLOGIES LAB | **Credit:2****Hours:3** |

**Course Objectives:**

**At the end of the course, the student should be able to do:**

* Learn how to create web pages using HTML, CSS and Javascript.
* Implement dynamic web pages using Javascript, Jquery and Angular Java script
* To create web applications using PHP and MySQL
* Create web pages using XML and Cascading Style Sheets
* Create XML documents and Schemas.

**Program List**

1. Develop a web page to display your education details in a tabular format.
2. Develop a web page to display your CV on a web page.
3. Design a Homepage having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links.
4. Design a web page to demonstrate the usage of inline CSS, internal CSS and external CSS.
5. Design an XML document and create a style sheet in CSS & display the document in the browser.
6. Develop a web page to Create image maps.
7. Design a web page to perform input validation using Angular Java script.
8. Develop a web page in PHP to fetch details from the database.
9. Design a web page to hide paragraph using JQuery
10. Create a web page and add Java script to handle mouse events and form events

**Course Outcomes:**

 On the successful completion of the course, students will be able

| **CO1** | Design dynamic web pages using JavaScript, Jquery and Angular Java script | K1 | LO |
| --- | --- | --- | --- |
| **CO2** | Develop Web pages using HTML, CSS and XML | K2 | IO |
| **CO3** | Create web application using PHP and MySQL | K3, K4 | HO |
| **CO4** | Develop interactive web pages using Jquery | K2,K3 | HO |
| **CO5** | To design dynamic web pages using Angular java script | K4,K5 | HO |

**Mapping with Programme Outcomes**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | M | S | S | S | S | M | M | S | M | M |
| CO2 | S | S | M | S | S | S | M | S | S | S |
| CO3 | S | S | S | M | M | S | M | M | S | M |
| CO4 | S | M | S | M | S | M | M | S | S | M |
| CO5 | M | M | S | M | S | S | M | S | M | M |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-B(i)****Skill Enhancement Course [SEC]-II** |  23PMCAS36 -2 : SOCIAL NETWORKING LAB | **Credit:2****Hours:3** |

**Course Objectives:**

* To familiarize the tools required to manage social network applications
* To analyze social networks like Facebook, LinkedIn, Google+, GitHub
* To teach the fundamental techniques and principles in achieving social networking environment.
* To enable students to have skills that will help them to solve real time applications.
* To get explore in the Github API.

**List of Programs**

1. Creating and Exploring Twitter’s API
2. To analyzing and visualizing tweets and tweet entities with frequency analysis
3. Creating and Exploring Facebook’s Social Graph API
4. To analyzing the Facebook’s Social Graph connections
5. Creating and Exploring LinkedIn API
6. To downloading LinkedIn connections as a CSV file
7. Creating and Exploring Google+ API
8. To create and querying Human Language Data with TF-IDF
9. Creating and Exploring GitHub’s API
10. To analyzing GitHub interest graph

**Course Outcomes**

**On the successful completion of the course, students will be able to**

|  |  |  |
| --- | --- | --- |
| **CO1:** | Understand AWS cloud services and manage the cloud data | **K1- K6** |
| **CO2:** | Develop secure, scalable, and well structured cloud solutions |
| **CO3:** | Implement EC2 instance and configure the instance |
| **CO4:** | Connect EC2 with Linux instance and perform operations |
| **CO5:** | To connect VPN server to access instances with more security |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | S | S | S | S | S | S | S | M | S | S |
| **CO2** | S | S | S | S | S | S | S | S | S | S | M | S |
| **CO3** | S | M | S | S | S | S | M | S | S | S | S | S |
| **CO4** | S | S | S | M | S | S | S | S | S | S | M | S |
| **CO5** | S | S | S | S | M | S | S | S | S | M | M | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: III****PART-B(ii)** | 23PMCAI37 : SUMMER INTERNSHIP | **Credit:2****Hours:-** |

**-Refer to the Regulations-**

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| **SEMESTER: IV****PART-A****CORE-XI** | 23PMCAC41: INDUSTRY DYNAMICS TECHNOLOGY - DATA VISUALISATION | **Credit:5****Hours:6** |

**Course Objectives**:

To understand the concepts and significance of data visualization.

To learn the visualization idioms and map data attributes to graphical attributes.

To evaluate the effectiveness of visualization designs.

To comprehend the considerations in information dashboard design.

**UNIT - I Introduction**

Visualization Definition and Need – Data Abstraction – Data Semantics and Types - Data Types – Dataset Types (DL) – Attribute Types – Semantics – Task Abstraction – Analyze tasks abstractly – Actions– Targets – Analyzing and Deriving.

**UNIT - II Analysis**

Four levels for Validation – Reasons to Validate – Four levels of Design – Angles of Attack – Threats to Validity – Validation Approaches – Validation Examples – Marks and Channels – Defining Marks and Channels – Using Marks and Channels – Channel Effectiveness – Relative versus Absolute Judgements – Rules of Thumb to be followed – No unjustified 3D - No unjustified 2D – Eyes beat memory – Resolution over Immersion – Overview, Zoom, Filter, Details on demand – Responsiveness is required – Get it Right in Black and White.

**UNIT - III Tables and Spatial Data**

Arrange by Keys and Values – Express: Quantitative Values – Separate, Order, and Align: Categorical Regions – Matrix Alignment: Two Keys – Volumetric Grid: Three Keys – Recursive Subdivision: Multiple Keys – Spatial Axis Orientation – Spatial Layout Density – Arrange Spatialdata – Geometry – Scalar Fields: One Value – Vector Fields: Multiple Values – Tensor Fields: Many Values.

**UNIT - IV Networks, Trees, Map Color**

Connection: Link Marks – Matrix Views - Connection versus Matrix – Containment: Hierarchy Marks – Map Color and Other Channels – Color Theory – Color maps – Other Channels – Reduce items and attributes – Reasons to Reduce - Filter – Aggregate – Manipulate View – Reasons for Change - Change View over Time – Select Elements – Navigate: Changing Viewpoint, Reducing Attributes.

**UNIT – V Information Dashboard Design**

Dashboards – Purpose – Importance – Reasons for Failure – Common Mistakes in Dashboard Design – Assessing what is needed from dashboards – Fundamental considerations in dashboard design – Visual perception and cognition to design dash board – An ideal library of graphs useful on dashboards.

**Text Books:**

1. Tamara Munzner, “Visualization Analysis and Design”, CRC Press, 2014.

2. Stephen Few, “Information Dashboard Design: Displaying Data for At-a-glance Monitoring”, Analytics Press, Second Edition, 2013.

**Reference Books**:

1. Ben Fry, “Visualizing Data”, O’Reilly, 2008.

2. Andy Kirk, “Data Visualization: A Successful Design Process”, PACKT Publishing, 2012.

3. Alexander Telea, “Data Visualization Principles and Practice”, CRC Press, Second Edition, 2014.

4. Julia Steele, Noah Ilinsky, “Beautiful Visualization: Looking at Data through the Eyes of Experts”, O’Reilly, 2010.

5. Karl Pover, “Leaning Qlik View Data Visualization”, PACKT, 2013.

6. Stephen Few, “Show Me the Numbers: Designing Tables and Graphs to Enlighten”, Analytics Press, Second Edition, June 2012.

**Course Outcomes**:

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

|  |  |
| --- | --- |
| **CO1** | Design and create data visualizations. |
| **CO2** | Apply data transformations such as aggregation and filtering for visualization. |
| **CO3** | Evaluate choice of colour and visual encoding suitable for visualization. |
| **CO4** | Build visual presentations of wide variety of data for effective communication. |
| **CO5** | Use knowledge of perception and cognition to design information dashboards. |

**Outcome Mapping**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** |  |  | S |  | S | M | S |  | M |  |
| **CO2** |  |  | S | M |  | S |  | S |  | M |
| **CO3** |  | S |  | M |  |  |  | S |  |  |
| **CO4** |  |  | M | S |  | L |  | S | L | S |
| **CO5** | S |  | L | S |  | S |  | M |  |  |

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| --- | --- | --- |
| **SEMESTER: IV****PART-A****CORE-XII** | 23PMCAC42: BIG DATA ANALYTICS | **Credit:5****Hours:6** |

**Course Objectives**

* To introduce big data tools & Information Standard formats.
* To understand the basic concepts of big data.
* To learn Hadoop, HDFS and Map Reduce concepts.
* To teach the importance of NoSQL.
* To explore the big data tools such as Hive, HBase and Pig.

**UNIT I**

**Big Data and Analytics:** Classification of Digital Data: Structured Data- Semi Structured Data and Unstructured Data.

Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop.

Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools

**UNIT II**

**Technology Landscape:**NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

**UNIT III**

**Mongodb and Map reduce Programming:** MongoDB: Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.

Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

**UNIT IV**

**Hive:** Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having – RCFile - Implementation - Hive User Defined Function - Serialization and Deserialization.

**UNIT V**

**Pig:** Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution – Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive

**Text Book:**

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publications, First Edition,2015

**Reference Book:**

* + - 1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, “Big data for dummies”, John Wiley & Sons, Inc. (2013)
			2. Tom White, “Hadoop The Definitive Guide”, O’Reilly Publications, Fourth Edition, 2015
			3. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, “Hadoop For Dummies”, Wiley Publications, 2014
			4. Robert D.Schneider, “Hadoop For Dummies”, John Wiley & Sons, Inc. (2012)
			5. Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 Chuck Lam, “Hadoop In Action”, Dreamtech Publications, 2010

**Course Outcomes**

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

| CO1: | To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools | K1-K6 |
| --- | --- | --- |
| CO2: | To collaborate, apply and review the computing for big data in Hadoop, and NoSQL environment.  | K1-K6 |
| CO3: | To comprehend, implement and review the concepts of data science and big data analytics projects using Map Reduce, and MongoDB | K1-K6 |
| CO4: | To understand, use and analyze the concepts of big data analytics projects using HIVE database. | K1-K6 |
| CO5: | To illustrate, develop and review the concepts of PIG database in Hadoop environment. | K1-K6 |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | S | - | - | - | - | L | - | - | - | - |
| CO2 | S | - | M | - | M | L | - | - | - | - |
| CO3 | S | - | S | - | S | L | - | - | - | S |
| CO4 | S | - | S | - | S | L | - | - | - | S |
| CO5 | S | - | S | - | S | L | - | - | - | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: IV****PART-A****PROJECT** | 23PMCAD43: PROJECT WITH VIVA VOCE | **Credit:7****Hours:10** |

**-Refer to the Regulations-**

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| **SEMESTER: IV****PART-A****ELECTIVE-VI****PRACTICAL** | 23PMCAE44-1: SOFT COMPUTING & LAB | **Credit:3****Hours:4** |

**Course Objectives:**

* Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
* To understand supervised and unsupervised learning algorithms
* To enable the students to gain a basic understanding of neural networks.
* To know about fuzzy logic, fuzzy inference systems, and their functions.
* To impart basic knowledge on Genetic algorithms and their applications.

**UNIT-I**

**INTRODUCTION TO SOFT COMPUTING:** Artificial Neural Networks- Biological Neurons- Basic Models of Artificial Neural Networks-Connections-Learning-Activation Functions- Important Terminologies of ANNs- Muculloch and Pitts Neuron-Linear Separability- Hebb Network-Flowchart of Training Process-Training Algorithm.

**UNIT - II**

**SUPERVISED LEARNING NETWORK** : Perceptron Networks–Perceptron Learning Rule-Architecture-Flowchart for Training Process-Perceptron Training Algorithms for Single Output Classes-Perceptron Training Algorithm for Multiple Output Classes-Perceptron Network Testing Algorithm - Adaptive Linear Neuron-Delta Rule for Single Output Unit-Flowchart for training algorithm-Training Algorithm – Testing Algorithm - Multiple Adaptive Linear Neurons-Architecture-Flowchart of Training Process-Training Algorithm-Back Propagation Network-Architecture-Flowchart for Training Process-Training Algorithm-Learning Factors of Back-Propagation Network-Radial Basis Function Network- Architecture-Flowchart for Training Process-Training Algorithm.

**UNIT-III**

**UNSUPERVISED LEARNING NETWORK:** Associative Memory Networks - Auto Associative Memory Network**-**Architecture-Flowchart for Training Process-Training Algorithm-Testing Algorithm- Bidirectional Associative Memory- Architecture-Discrete Bidirectional Associative Memory-Iterative Auto Associative Memory Networks - Linear Auto Associative Memory-Kohonen Self-Organizing Feature Map- Architecture-Flowchart for Training Process-Training Algorithm.

**UNIT-IV**

**INTRODUCTION TO FUZZY LOGIC:** Classical Sets –Operations on Classical Sets-Fuzzy sets - Fuzzy Sets- Properties of Fuzzy Sets- Fuzzy Relations –Membership Functions: Fuzzification- Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods–Max-Membership Principle-Centroid Method-Weighted Average Method-Mean Max Membership-Center of Sums-Center of Largest Area-First of Maxima - Fuzzy Set Theory - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Measures – Belief and Plausibility Measures-Probability Measures-Possibility and Necessity Measures- Formation of Rules –Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

**UNIT-V**

**GENETIC ALGORITHM**: Introduction - Biological Background - Traditional Optimization and Search Techniques -Gradient Based Local Optimization Method-Random Search-Stochastic Hill Climbing-Simulated Annealing-Symbolic Artificial Intelligence-Operators in Genetic Algorithm -Encoding-Selection-Crossover-Mutation - Stopping Conditions for Genetic Algorithm Flow-Genetic Programming-Working of Genetic Programming-Characteristics of Genetic Programming-Data Representation.

**Course Objectives:**

* To implement various Supervised Neural Network-based approaches
* To apply the fuzzy-based logical operations and arithmetic operations
* To implement unsupervised neural network approaches
* To solve a problem using a simple genetic algorithm
* To implement logic gates.

**Program List**

# Implementation of Logic gates using Artificial Neural Network.

1. Implementation of Perception Algorithm.
2. Implementation of Back Propagation Algorithm.
3. Implementation of Self Organizing Maps.
4. Implementation of Radial Basis Function Network.
5. Implementation of De-Morgan’s Law.
6. Implementation of McCulloch Pits Artificial Neuron model
7. Implementation of Simple genetic algorithm
8. Implementation of fuzzy based Logical operations
9. Implementation of fuzzy based arithmetic operations

**Text Books**

1. Principles of Soft Computing, S.N. Sivanandam, S.N.Deepa, Wiley, Third Edition, 2019.

 **UNIT I:** Chapter 1: 2.1,2.3,2.4,2.5,2.6,2.7

 **UNIT II:** Chapter 2: 3.2,3.3,3.4,3.5,3.6

 **UNIT III:** Chapter 3: 4.3,4.4,4.7,5.3

 **UNIT IV:** Chapter 4: 7.2,7.3,8.4,9.3,9.4,10,10.2,10.3,10.4,11.4,12.8,14

 **UNIT V:** Chapter 5: 15,15.2,15.3,15.4,15.9,15.10

**Reference Books**

1. Das, A. (2018). Artificial Intelligence and Soft Computing for Beginners.
2. Amit, K. (2018). Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain. CRC press.
3. Rajasekaran, S., &Pai, G. V. (2011). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd.
4. Jang, J. S. R., Sun, C. T., &Mizutani, E. (2004). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.
5. Gupta, M. M. (2004). Soft computing and intelligent systems: theory and applications. Elsevier.
6. Jang, J. S. R., Sun, C. T., &Mizutani, E. (1997). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

**Course Outcomes:**

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

| **CO1** | To provide an introduction to the basic principles, techniques, and applications of soft computing | K- 1 K2 | LO |
| --- | --- | --- | --- |
| **CO2** | To get familiar with Neural network architectures and supervised learning algorithms | K3 | IO |
| **CO3** | To understand the architectures and algorithms of Unsupervised Learning techniques | K3- K4 | HO |
| **CO4** | Develop the skills to gain a basic understanding of fuzzy logic theory and fuzzy inference systems | K4 | IO |
| **CO5** | Ability to learn traditional optimization and search techniques and genetic programming | K5 | HO |

**Mapping With Programme Outcomes**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | M | S | M | S | S | S | M | S | M |
| **CO2** | M | S | M | S | M | M | M | S | M | S |
| **CO3** | M | M | S | S | S | M | M | S | S | S |
| **CO4** | S | S | M | M | M | S | S | S | S | M |
| **CO5** | S | S | S | S | S | M | S | M | M | S |

**S- Strong; M-Medium; L-Low**

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| --- | --- | --- |
| **SEMESTER: IV****PART-A****ELECTIVE-VI****PRACTICAL** | 23PMCAE44 – 2 : INTERNET OF THINGS AND LAB | **Credit:3****Hours:4** |

**Course Objectives:**

* To get familiar with the evolution of IOT with its design principles
* To outline the functionalities and protocols of internet communication
* To analyze the hardware and software components needed to construct IOT applications
* To identify the appropriate protocol for API construction and writing embedded code
* To realize various business models and ethics in Internet of Things

**UNIT I:**

**Fundamentals of IoT**

Evolution of Internet of Things – Enabling Technologies – IOT Architectures: oneM2M, IOT World Forum (IOTWF) and Alternative IOT models – Simplified IOT Architecture and Core IOT Functional Stack -– Fog, Edge and Cloud in IOT – Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

## UNIT II

## IoT Protocols

IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IOT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

**UNIT III**

**Design and Development**

Prototyping Embedded Devices: Electronics - Embedded Computing Basics – Arduino - Raspberry Pi - Beagle Bone Black - Electric Imp. Prototyping the Physical Design: Non digital Methods - Laser Cutting - 3D printing - CNC Milling - Repurposing/Recycling.

**UNIT IV**

Prototyping Online Components: Getting started with an API - Writing a New API - Real-Time Reactions - Other Protocols. Techniques for Writing Embedded Code: Memory Management - Performance and Battery Life – Libraries - Debugging.

**UNIT V**

Business Models: History of Business Models – Model – Internet of Starting up – Lean Startups. Moving to Manufacture: Designing Kits - Designing Printed circuit boards – Certification – Costs - Scaling Up Software. Ethics: Privacy – Control – Environment – Solutions.

**Lab Course Objective :**

**Program List**

1. To develop an IoT program to turn ON/OFF LED light (3.3V)
2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.)
3. To develop an IoT program using Humidity and Temperature Monitoring (Forest fire Detection, Weather Monitoring)
4. To develop an IoT web server program for local hosting
5. To develop an IoT program using Soil Moisture Sensor
6. To develop an IoT program using Ultrasonic Sensor (Distance Measurement, etc.)
7. To develop an real-time IoT program using Relay Module (Smart Home Automation with 230V)
8. To develop an IoT program for Fire Detection (Home, Industry,etc.)
9. To develop an IoT program for Gas Leakage detection (Home, Industry, etc.)
10. To develop an IoMT program using Heartbeat Sensor

**Text Books:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 (UNIT I and II)
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014. (UNIT III, IV and V)

**Reference Books:**

1. Ovidiu Vermesan and Peter Friess, “Internet of Things – From Research and Innovation to Market Deployement” , River Publishers, 2014.
2. Peter Waher, “Learning Internet of Things” ,Packt Publishing, 2015.
3. Donald Norris, “The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBoneBlack”,McGraw Hill, 2015.

**Course Outcomes**

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

| **CO1:** | Comprehend the IoT evolution with its architecture and sensors | **K1- K6** |
| --- | --- | --- |
| **CO2:** | Understand the networking concepts for communication and underlying IoT protocols  |
| **CO3:** | Assess the embedded technologies and develop prototypes for the IoT products |
| **CO4:** | Evaluate the use of Application Programming Interface and design an API for IoT in realitime |
| **CO5:** | Recognize the ethics of business models and perform security analysis |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create**

**Mapping with Programme Outcomes**

|   | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | M | S | S | S | S | S | S | S |
| **CO2** | S | S | S | S | S | S | S | M | S | S |
| **CO3** | S | M | S | S | S | S | M | S | S | M |
| **CO4** | S | S | S | S | S | S | S | S | S | S |
| **CO5** | S | S | S | S | M | S | S | S | S | M |

**S- Strong; M-Medium; L-Low**

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| **SEMESTER: IV****PART-B(i)**PRACTICAL  | SKILL ENHANCEMENT COURSE [SEC]-III: 23PMCAS45-1: CYBER SECURITY LAB | **Credit:2****Hours:4** |

**COURSE OBJECTIVES**

* To learn and implement to Change the wireless device mode as monitor mode
* To develop in multiple vulnerabilities web server
* To understand and implement the open ports in the network
* To acquire programming skills in Implement various wireless device modes
* To comprehend related to find the sub domains of webpage

Implement the following using any cyber security tools

1. Install virtual box (kali Linux)
2. Generate a secure password using keepass
3. Change the wireless device mode as monitor mode
4. Find the known and open vulnerabilities of system using metaspolit
5. Identify the multiple vulnerabilities webserver using nikto tool
6. Identify the open ports in the network using nmap tools
7. List all the network around us and display the information about the networks
8. Sniff and capture the packet sent over HTTP requests
9. Find the owners of internet resources using Who is Lookup tool
10. Find the subdomains of webpage using knock tool

**Course Outcomes:**

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

| **CO1:** | Comprehend the programming skills in Change the wireless device mode as monitor mode | **K1-K6** |
| --- | --- | --- |
| **CO2:** | Understand and implement multiple vulnerabilities webserver  | **K1-K6** |
| **CO3:** | Evaluate the use of different wireless device modes | **K1-K6** |
| **CO4:** | Design to Solve related to find the subdomains of webpage | **K1-K6** |
| **CO5:** | Create and apply open ports in the network | **K1-K6** |

**K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create**

**Mapping Course outcomes with Programme outcomes**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | - | - | - | - | L | - | - | - | - |
| **CO2** | S | - | M | - | M | L | - | - | - | - |
| **CO3** | S | - | S | - | S | L | - | - | - | S |
| **CO4** | S | - | S | - | S | L | - | - | - | S |
| **CO5** | S | - | S | - | S | L | - | - | - | S |

**S- Strong; M-Medium; L-Low**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: IV****PART-B(i)**PRACTICAL  | SKILL ENHANCEMENT COURSE [SEC]-III: 23PMCAS45 -2: BLOCKCHAIN TECHNOLOGY LAB | **Credit:2****Hours:4** |

**Course Objectives**

* To learn the basics of Blockchain and apply cryptographic algorithms
* To design, build, and deploy smart contracts and distributed applications,
* To deploy Private Blockchain and smart contracts on Ethereum.
* To understand and deploy cryptocurrencies and their functions in applications
* To implement Blockchain for various use cases.

**Implement the following**

1. Create a Public Ledger and Private Ledger with the various attributes like Access, Network Actors, Native token, Security, Speed and examples.
2. Building and Deploying MultiChain private Blockchain
3. Write Hello World smart contract in a higher programming language (Solidity)
4. Construct the Naïve block chain
5. Construct and deploy your contract (Use deploy method)
6. Set up a Regtest environment
7. Build a payment request URI
8. Hashcash implementation
9. Develop a toy application using Blockchain
10. Create simple wallet transaction from one account to another account using Metamask.

**Course Outcomes**

On the successful completion of the course, students will be able to:

| **CO1:** | Enable to setup your own private Blockchain and deploy smart contracts on Ethereum. | **K1-K6** |
| --- | --- | --- |
| **CO2:** | Gains familiarity and implement with cryptography and Consensus algorithms. | **K1-K6** |
| **CO3:** | Create and deploy projects using Web3j. | **K1-K6** |
| **CO4:** | Recall and deploy the structure and mechanism of Bitcoin, Ethereum, Hyperledger | **K1-K6** |
| **CO5:** | Implement Blockchain for various use cases | **K1-K6** |

**Mapping with Programme Outcomes:**

|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | S | S | M | L | M | S | - | - | - | - |
| **CO2** | S | M | S | S | S | M | - | - | - | - |
| **CO3** | S | S | S | S | S | S | - | - | - | - |
| **CO4** | S | M | L | S | M | L | - | - | - | - |
| **CO5** | M | S | M | L | S | L | - | - | - | - |

**S – Strong, M – Medium, L – Low**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: IV****PART- C** | 23PMCAX46: EXTENSION ACTIVITY | **Credit:1****Hours:-** |

**-Refer to the Regulations-**

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