**Title of the Course : DISCRETE MATHEMATICS**

**Category of the Course : CORE COURSE**

**Course Code : P1R3CACC1**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 25 + **Ext:** 75 = 100 **Hrs / Week: 07**

**Credit: 05** **Total Inst. Hours: 105**

**COURSE OBJECTIVES:**

1. To know the concepts of relations and functions.
2. To distinguish among different normal forms and quantifiers.
3. To solve the recurrence relations and permutations & combinations.
4. To understand and solve matrices, rank of matrix & characteristic equations.
5. To study the graphs and its types.

**Unit-I - RELATIONS (Inst. Hrs: 21)**

**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 (Inst.Hrs: 21)**

**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 (Inst.Hrs: 21)**

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 (Inst. Hrs: 21)**

**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** **(Inst. Hrs: 21)**

**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 BOOK (S)**

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

**REFERENCE BOOK (S)**

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

**WEB RESOURCES**

1. https://discrete.openmathbooks.org/

**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 |
| CO2: | To analyze and evaluate the recurrence relations | K5 |
| CO3: | To distinguish among various normal forms and predicate calculus | K5 |
| CO4: | To solve and know various types of matrices | K1 |
| CO5: | To evaluate and solve various types of graphs | K5 |

**Title of the Course : LINUX AND SHELL PROGRAMMING**

**Category of the Course : CORE COURSE**

**Course Code : P1R3CACC2**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 25 + **Ext:** 75 = 100 **Hrs/Week: 07**

**Credit: 05** **Total Inst. Hours: 105**

**COURSE OBJECTIVES :**

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

**Unit-I : BASIC BASH SHELL COMMANDS (Inst.Hrs : 21)**

**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.

**Unit-II: STRUCTURED COMMANDS (Inst.Hrs : 21)**

**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.

**Unit-III : FUNCTIONS (Inst.Hrs : 21)**

**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.

**Unit-IV : REGULAR EXPRESSIONS (Inst.Hrs : 21)**

**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.

**Unit-V : WORKING WITH ALTERNATIVE SHELLS (Inst.Hrs : 21)**

**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.

**TEXT BOOK (S):**


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 BOOK (S):**


1. ClifFlynt,SarathLakshman,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

**WEB RESOURCES**

1.https://booksoncode.com/articles/best-shell-scripting-books-for-beginners

**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 | K3 |
| CO2: | To comprehend, impart and apply fundamentals of control structure and script controls | K2 |
| CO3: | To understand, analyses and evaluate the functions, graphical desktop interface and editors | K5 |
| CO4: | To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk | K4 |
| CO5: | To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python | K1 |

**MAPPING WITH PROGRAMME OUTCOMES**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO5 | PO 6 | PO 7 | PO8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | - | S | L | - | M | M | M | M | S |
| CO2 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO3 | S | S | M | - | S | L | - | M | M | S | S | S |
| CO4 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO5 | S | S | M | - | S | L | - | M | M | M | M | S |

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

**Title of the Course : PYTHON PROGRAMMING**

**Category of the Course : CORE COURSE**

**Course Code : P1R3CACC3**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 25 + **Ext:** 75 = 100 **Hrs/Week: 06**

**Credit: 04** **Total Inst.Hours: 90**

**COURSE OBJECTIVES:**

1. To acquire programming skills in core Python.
2. To learn Strings and function.
3. To develop object oriented skills in Python.
4. To comprehend various Python Packages.
5. To develop web applications using Django.

**Unit I : INTRODUCTION TO PYTHON (Inst. Hrs: 18)**

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 (Inst. Hrs: 18)**

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 : CLASSES (Inst. Hrs: 18)**

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 : PYTHON PACKAGES (Inst. Hrs: 18)**

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The DataFrame - 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** **(Inst. Hrs: 18)**

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 (S):**

1. K.A. Lambert, " Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 **(Unit - I, II and III)**
2. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018 **(Unit - IV)**
3. 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 visualization | |
| **CO5** | Design interactive web applications using Django | |

**MAPPING WITH PROGRAMME OUTCOMES:**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO5 | PO 6 | PO 7 | PO8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | - | S | L | - | M | M | M | M | S |
| CO2 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO3 | S | S | M | - | S | L | - | M | M | S | S | S |
| CO4 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO5 | S | S | M | - | S | L | - | M | M | M | M | S |

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

**Title of the Course : DATA ENGINEERING AND MANAGEMENT**

**Category of the Course : ELECTIVE 1**

**Course Code : P1R3CAEC1:1**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 25 + **Ext:** 75 = 100 **Hrs / Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES:**

1. To understand Data Management concepts.
2. To get brief knowledge on Data Modeling.
3. To analyse the techniques used in Distributed Databases.
4. To assess Distributed database and Business Modeling.
5. To get familiar with CRM tools.

**UNIT-I - DATABASE DEVELOPMENT (Inst. Hrs: 15)**

DATABASE DEVELOPMENT: Database architecture of an information system-Overview of the database development process-Conceptual data modeling-Relational data analysis-Roles of a data model-Physical database design. DATA MANAGEMENT: Problems encountered without data management-Data management responsibilities-Data management activities-Roles within data management-Benefits of data management-Relationship between data management and enterprise

**UNIT-II- CORPORATE DATA MODELLING (Inst. Hrs: 15)**

CORPORATE DATA MODELLING: Need for a corporate data model-Nature of a corporate data model- Develop a corporate data model - Corporate data model principles. DATA DEFINITION AND NAMING: Elements of a data definition-Data naming conventions. DATA QUALITY: Issues associated with poor data quality-Causes of poor data quality-Dimensions of data quality-Data model quality-Improving data quality. DATA ACCESSIBILITY: Data security-Data integrity-Data recovery

**UNIT-III- USE OF PACKAGED APPLICATION SOFTWARE (Inst. Hrs: 15)**

USE OF PACKAGED APPLICATION SOFTWARE: Application software packages-Impact on data management. DISTRIBUTED DATA AND DATABASES: Rationale for distributing data-Perfect distributed database system-Top down fragmentation and partitioning. Bottom up integration-The management of replication. BUSINESS INTELLIGENCE: Data warehousing-Multidimensional model of data-Standard reporting tools-Online analytical processing OLAP-Relational schema for a data warehouse.

**UNIT-IV: CRM** **(Inst. Hrs: 15)**

CRM: Three main pillars of CRM. GETTING TO KNOW YOUR CUSTOMER: 360-degree client view. UTILIZING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN YOUR CRM STRATEGY: Evolution of AI-Current state of AI-Teaming up AI with people-Applying AI to your CRM solution-ethical aspects of AI-An example of AI in CRM processes.

**UNIT-V: CLOUD VERSUS ON PREMISE VERSUS HYBRID** **(Inst. Hrs: 15)**

CLOUD VERSUS ON PREMISE VERSUS HYBRID: Factors influencing vendor selection-Hybrid deployment-what are your options. CRM DIFFERENTIATORS: It's not about the feature list; it's about the ecosystem-Fourth industrial revolution and CRM-AI and smart cloud-To cloud or not to cloud-Leveraging smart cloud into CRM-Big data-Social selling and advertising-Implementation tools-Sustainable CRM platform.

**TEXT BOOK (S):**


1. Keith Gordon, "Principles of Data Management Facilitating Information Sharing", BCS Learning, 2013. (Chapters:1-5, 7,8,12,13,14)
2. Max Fatouretchi, "The Art of CRM", Packt Publishing, 2019.(Chapters: 1,2,5,8,9)


**REFERENCE BOOK (S):**


1. Peter Ghavami, "Big Data Management_ Data Governance Principles for Big Data Analytics", De Gruyter, 2020.
2. Francis Buttle, Stan Maklan, Customer Relationship Management Concepts and Technologies, Routledge, 2019.


**COURSE OUTCOME (S):**

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

| Course Outcomes | Description | Knowledge Level |
|---|---|---|
| CO1 | Comprehend the Data Management concepts and analyse the relationship with the enterprise | K1- K6 |
| CO2 | Analyze Data Modelling concepts and assess its quality | |
| CO3 | Understand and implement business modelling techniques | |
| CO4 | Evaluate the use of Artificial Intelligence and Machine Learning in CRM | |
| CO5 | Develop CRM applications in cloud | |

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

**MAPPING WITH PROGRAMME OUTCOMES:**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO5 | PO 6 | PO 7 | PO8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | - | S | L | - | M | M | M | M | S |
| CO2 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO3 | S | S | M | - | S | L | - | M | M | S | S | S |
| CO4 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO5 | S | S | M | - | S | L | - | M | M | M | M | S |

L - Low, M- Medium, S – Strong

**Title of the Course : ARCHITECTURE AND FRAMEWORKS**

**Category of the Course : ELECTIVE 1**

**Course Code : P1R3CAEC1:2**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 25 + **Ext:** 75 = 100 **Hrs / Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES:**

1. To understand the basics, benefits and purpose of software architecture.
2. To Understand the quality attributes to fulfil the software requirements.
3. To Explore the design patterns, best practice and paradigms of efficient software.
4. To Understand the performance and security measures of software architecture.
5. To Enable the developers to advance their career in software domain.

**UNIT – I- SOFTWARE ARCHITECTURE INTRODUCTION (Inst. Hrs: 15)**

Software architecture introduction – Importance of Software architecture –Software architecture consumers – Architect role - software architecture in an organization – Types of software architects – Software development methodologies – Project management – Office politics – Software risk management – Configuration management – Software product lines

**UNIT – II- DOMAIN KNOWLEDGE (Inst. Hrs: 15)**

Domain Knowledge – Developing business acumen – Domain-driven design – requirement engineering – requirement elicitation –Software Quality attributes: Maintainability – Usability –Availability – Portability – Interoperability - Testability

**UNIT – III- SOFTWARE ARCHITECTURES DESIGN (Inst. Hrs: 15)**

Software Architectures design – Importance - Top-down Versus bottom-up design approaches – Architectural drivers – Documenting the Software architecture design – Systematic approach - Attribute-driven design – Microsoft's technique for architecture and design –Architecture-centric design method – Architecture development method – Tracking the progress of the software architecture's design.

**UNIT – IV- ORTHOGONAL SOFTWARE SYSTEMS (Inst. Hrs: 15)**

Designing orthogonal software systems – Minimizing complexity – SOLID design principles – Software architecture patterns – layered – Event-driven architecture – Model-View patterns – Service-oriented architecture

**UNIT – V- ARCHITECTING MODERN APPLICATIONS (Inst. Hrs: 15)**

Architecting Modern Applications.- Importance of Performance – Performance improvement - Server side caching – Web application performance – Database performance -Securing

software systems – Threat modelling – Secure by design

**TEXT BOOK (S):**

1. Joseph Ingeno, "Software Architect's Handbook" Packt Publishing 2018.

**REFERENCE BOOK (S):**

1. Oliver Vogel, Indo Arnold, ArifChughtaiandTImoKehrer, "Software Architecture" Springer-Verlag, 2011.
2. Ian Gorton, "Essential Software architecture", Second Edition, Springer, 2011
3. Len Bass, Paul Clements and Rick Kazman, "Software architecture in practice", Third edition, Addison-Wesley, 2013

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

| | | |
|---|---|---|
| CO1 | Understand, analyze and evaluate the purpose of Software architecture and development methodologies with consideration of risk management | K1-K6 |
| CO2 | Comprehend, apply and evaluate the domain knowledge for software development process and determine the impact of quality attributes. | K1-K6 |
| CO3 | Understand, track and examine the systematic approach for various software design models with effective document process | K1-K6 |
| CO4 | Illustrate and summarize the functions of orthogonal systems with complexity, design principles and design pattern for software architecture | K1-K6 |
| CO5 | Comprehend, analyze and evaluate the performance and security measures for Server, Web and Database applications in order to create the secure software systems for various domain applications | K1-K6 |

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

**MAPPING WITH PROGRAMME OUTCOMES:**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO5 | PO 6 | PO 7 | PO8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | - | S | L | - | M | M | M | M | S |
| CO2 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO3 | S | S | M | - | S | L | - | M | M | S | S | S |
| CO4 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO5 | S | S | M | - | S | L | - | M | M | M | M | S |

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

**Title of the Course : NETWORK PROTOCOLS**

**Category of the Course : ELECTIVE 1**

**Course Code : P1R3CAEC1:3**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 25 + **Ext:** 75 = 100 **Hrs / Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES:**

1. To understand the basic concepts of Transmission Control Protocol/Internet Protocol.
2. To describe the internet architecture and its processes with the data transfer.
3. To understand technologies and services associated with network protocols.
4. Learners will understand the importance and functioning of Routing Protocols.
5. Empower the learners to manage the issues associated with IP protocols.

**UNIT I - TRANSMISSION CONTROL PROTOCOL (Inst. Hrs: 15)**

Transmission Control Protocol/Internet Protocol : Fundamental Architecture - Internet Protocol Basics - Routing - Transport-Layer Protocols : Transmission Control Protocol - User Datagram Protocol - Stream Control Transmission Protocol - Real-Time Transport Protocol.

**UNIT II - INTERNET ARCHITECTURE (Inst. Hrs: 15)**

Internet Architecture: Internet Exchange Point - History of Internet Exchange Points - Internet Service Provider Interconnection Relationships - Peering and Transit - IP Routing Protocols: Overview of Routing Protocols - Routing Information Protocol - Open Shortest Path First - Border Gateway Protocol - Multiprotocol Label Switching.

**UNIT III- IP QUALITY OF SERVICE (Inst. Hrs: 15)**

IP Quality Of Service : Introduction - Quality of Servicein IP Version 4 - Integrated Services - Differentiated Services - Quality of Service with Nested Differentiated Services Levels - IP Multicast and Anycast: Addressing - Multicast Routing - Routing Protocols –Anycasting- IPv6 Anycast Routing Protocol: ProtocolIndependent Anycast—Sparse Mode - Transport over Packet: Draft-Martini Signaling and Encapsulation - Layer-2 Tunneling Protocol.

**UNIT IV - VIRTUAL PRIVATE WIRED SERVICE (Inst. Hrs: 15)**

Virtual Private Wired Service - Types of Private Wire Services - Generic Routing Encapsulation - Layer-2 Tunneling Protocol - Layer-3 Virtual Private Network 2547bis, Virtual Router - IP and Optical Networking: IP/Optical Network Evolution - Challenges in Legacy Traditional IP/Optical Networks - Automated Provisioning in IP/Optical Networks - Control Plane Models for IP/Optical Networking - Next-Generation MultiLayer Network

Design Requirements - Benefits and Challenges in IP/Optical Networking - IP Version 6: Addresses in IP Version 6 - IP Packet Headers - IP Address Resolution - IP Version 6 Deployment: Drivers and Impediments.

**UNIT V - IP TRAFFIC ENGINEERING (Inst. Hrs: 15)**

IP Traffic Engineering: Models of Traffic Demands - Optimal Routing with Multiprotocol Label Switching - Link-Weight Optimization with Open Shortest Path First - Extended Shortest-Path-Based Routing Schemes - IP Network Security: Introduction - Detection of Denial-of-Service Attack - IP Trace back- Edge Sampling Scheme - Advanced Marking Scheme - Mobility Support for IP: Mobility Management Approaches - Security Threats Related to IP Mobility - Mobility Support in IPv6 - Reactive Versus Proactive Mobility Support - Relation to Multihoming - Protocols Supplementing.

**TEXT BOOK (S):**


1. "Advanced Internet Protocols, Services and Applications", Eiji Oki, Roberto Rojas-Cessa, MallikarjunTatipamula, Christian Vogt, Copyright © 2012 by John Wiley & Sons, Inc.


**REFERENCE BOOK (S) :**


1. "TCP/IP Protocol Suite", BehrouzA.Forouzan, Fourth Edition, Tata Mcgraw-Hill Edition 2010.
2. "Computer Communications and Networking Technologies" - Michael A. Gallo & William M. Hancock- BROOKS&COLE
3. "Computer Networks and Internets" -Douglas E. Comer- PEARSON.
4. Data and Computer Communications- Eighth Edition- William Stallings- Pearson Education.
5. Network Security Bible, 2nd edition, Eric Cole, Wiley Publishers.
6. Data communication and networks –James Irvine and David Harley- Publishers: Wiley India

**COURSE OUTCOME (S):**

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

| | | |
|---|---|---|
| CO1 | Understand, analyse and examine the concepts of Communication Protocols with its architecture and functions | K1- K6 |
| CO2 | Illustrate and apply the appropriate internet architecture along with efficient protocol models for the user defined communication environment | K1- K6 |
| CO3 | Comprehend, categorize and formulate the appropriate IP routing protocol to establish a efficient data transfer | K1- K6 |
| CO4 | Comprehend, analyse and evaluate the concepts of Virtual wired service and IP/optical networking with its functions and deployment | K1- K6 |
| CO5 | Elucidate, analyse and inspect the IP traffic engineering and its models along with the security mechanisms | K1- K6 |

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

**MAPPING WITH PROGRAMME OUTCOMES:**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO5 | PO 6 | PO 7 | PO8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | - | S | L | - | M | M | M | M | S |
| CO2 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO3 | S | S | M | - | S | L | - | M | M | S | S | S |
| CO4 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO5 | S | S | M | - | S | L | - | M | M | M | M | S |

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

**Title of the Course : DOT NET TECHNOLOGIES**

**Category of the Course : ELECTIVE 1**

**Course Code : P1R3CAEC1:4**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 25 + **Ext:** 75 = 100 **Hrs / Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES :**

1. To get strong understanding of .NET Framework and C# programming.
2. To get advanced programming skills in Visual Studio with C# language.
3. To get advanced methods of manipulating data using Microsoft SQL Server.
4. To get clear idea of how to developing real-time standalone, web applications using .NET Technologies.
5. To get clear understanding and get experience in Microsoft Azure.

**Unit-I : INTRODUCING C#: .NET FRAMEWORK (Inst. Hrs: 15)**

Introducing C#: .NET Framework - C# language - Visual Studio 2017 - Writing a C# Program: Visual Studio 2017 Development Environment - Console Applications - Desktop Applications - Variables and Expressions: Basic C# Syntax - Basic C# Console Application Structure - Variables - Expressions - Flow Control: Boolean Logic – Branching - Looping.

**Unit-II: FUNCTIONS (Inst.Hrs:15)**

More About Variables: Type Conversion - Complex Variable Types - String Manipulation – Functions: Defining and Using Functions - Variable Scope - The Main Function - Struct Functions - Overloading Functions - Using Delegates - Debugging and Error Handling: Debugging in Visual Studio - Error Handling - Introduction to Object Oriented Programming: Object-Oriented Programming - OOP Techniques - OOP in Desktop Applications.

**Unit-III : CLASSES (Inst. Hrs: 15)**

Defining Classes: Class Definitions in C# - System.Object - Constructors and Destructors - OOP Tools in Visual Studio - Class Library Projects - Interfaces Versus Abstract Classes - Struct Types - Shallow Copying Versus Deep Copying - Defining Class Members: Member Definitions - Additional Class Member Topics - Interface Implementation - Partial Class Definitions - Partial Method Definitions - The Call Hierarchy Window - Basic Cloud Programming: Cloud, Cloud Computing, and the Cloud Optimized Stack - Cloud Patterns and Best Practices - Using Microsoft Azure C# Libraries to Create a Storage Container - Creating an ASP.NET 4.7 Web Site That Uses the Storage Container - Advanced Cloud Programming and Deployment: Creating an ASP.NET Web API - Deploying and Consuming

an ASP.NET Web API on Microsoft Azure - Scaling an ASP.NET Web API on Microsoft Azure.

**Unit-IV: .NET STANDARD AND .NET CORE (Inst. Hrs: 15)**

.NET Standard and .NET Core: Cross-Platform Basics and Must Know Terms – Need of .NET - Referencing and Targeting Frameworks - .NET Core - Building and Packaging a.NET Standard Library - Building a .NET Core Application with Visual Studio - Porting from .NET Framework to .NET Core - ASP.NET and ASP.NET Core: Overview of Web Applications – Use of ASP.NET - ASP.NET Web Forms - Creating ASP.NET Core Web Applications – Files: File Classes for Input and Output – Streams - Monitoring the File System - XML and JSON: XML Basics - JSON Basics - XML Schemas - XML Document Object Model - Converting XML to JSON - Searching XML with XPath.

**Unit-V: LINQ (Inst. Hrs: 15)**

LINQ: LINQ to XML - LINQ Providers - LINQ Query Syntax - LINQ Method Syntax - Ordering Query Results - Understanding the orderby Clause - Querying a Large Data Set - Using Aggregate Operators - Using the Select Distinct Query - Ordering by Multiple Levels - Using Group Queries - Using Joins – Databases: Using Databases - Installing SQL Server - Express - Entity Framework - Code First Database - Finding the Database - Navigating Database Relationships - Handling Migrations - Creating and Querying XML from an Existing Database - Universal Apps: Windows Universal Apps - App Concepts and Design - App Development - Common Elements of Windows Store Apps - Windows Store.

**TEXT BOOK (S):**

1. Benjamin Perkins, Jacob Vibe Hammer, Jon D. Reid, “Beginning C#7 Programming with Visual Studio 2017”, Wiley Publishing, 2018.Chapters: 1 to 10, 16 to 23, and 25.

**REFERENCE BOOK (S):**

1. Nagel, Christian, “Professional C 7 and .NET Core 2.0 ”, Wrox Publishing, 2018.
2. Mehboob Ahmed Khan, Ovais, “C# 7 and .NET Core 2.0 High Performance”, Packt Publishing, 2018

**COURSE OUTCOMES:**

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

| | | | |
|---|---|---|---|
| CO1 | Understand and learn .NET Framework and C# .NET | K1, K2 | LO |
| CO2 | Apply the concepts to develop the applications for real-time problem in C# .NET and ASP .NET | K3 | IO |
| CO3 | Analyze the feasibility of using .NET for real time problems | 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 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | M | L | L | L | - | - | - | - | - | L |
| CO2 | S | M | L | M | M | L | - | L | - | L | - | L |
| CO3 | S | S | S | M | M | L | - | L | - | L | - | L |

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

**Title of the Course : DATA ENGINEERING AND MANAGEMENT LAB**

**Category of the Course : ELECTIVE 2**

**Course Code : P1R3CAEC1:1P**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 40 + **Ext:** 60 = 100 **Hrs/Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES:**

1. To acquire basic scripting knowledge in MongoDB
2. To learn CRUD Operation on MongoDB database
3. To comprehend MongoDB using DbVisualizer
4. To be familiar with Zoho CRM features
5. To customize your application using Zoho CRM

## List of Practical:

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 DbVisualizer
8. Perform CRUD operations using DbVisualizer
9. Create a Zoho CRM account and organize your Tasks, Meetings and Deals
10. Create and maintain a project using Zoho CRM features

**COURSE OUTCOME (S):**

**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 DbVisualizer | |
| **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:**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO5 | PO 6 | PO 7 | PO8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | - | S | L | - | M | M | M | M | S |
| CO2 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO3 | S | S | M | - | S | L | - | M | M | S | S | S |
| CO4 | S | S | M | - | S | L | - | M | M | M | M | S |
| CO5 | S | S | M | - | S | L | - | M | M | M | M | S |

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

**Title of the Course : ARCHITECTURE AND FRAMEWORKS - LAB**

**Category of the Course : ELECTIVE 2**

**Course Code : P1R3CAEC1:2P**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 40 + **Ext:** 60 = 100 **Hrs/Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES:**

1. To implement the basic concepts of Software architecture and its functions.
2. To acquire programming skills to develop various technologies and services associated with network protocols along with the challenges of data transfer.
3. To Implement the importance and functioning of Routing Protocols over communication service.
4. To acquire skills to connect two routers and any two switches.
5. 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 WebID 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 WebSockets API
7. Writing resources from HTTP REST API and WebSockets 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:**

**O**n 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 | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO9 | PO10 | PO 11 | PO 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | M | L | M | S | - | - | - | - | - | - |
| CO2 | S | M | S | S | S | M | - | - | - | - | - | - |
| CO3 | S | M | S | M | S | M | - | - | - | - | - | - |
| CO4 | S | M | L | S | M | L | - | - | - | - | - | - |
| CO5 | M | S | M | L | S | L | - | - | - | - | - | - |

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

**Title of the Course : NETWORK PROTOCOLS LAB**

**Category of the Course : ELECTIVE 2**

**Course Code : P1R3CAEC1:3P**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 40 + **Ext:** 60 = 100 **Hrs/Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES:**

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

**List of Practicals:**

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

1. Implement the following commands
    - ipconfig
    - ping
    - traceroute
    - netsat
    - nslookup
2. Implement the following server commands
    - ifconfig
    - ip
    - tracepath
    - ss
    - 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 OUTCOME (S):**

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 | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | - | L | - | - | - | - | - | - |
| CO2 | S | - | M | - | M | L | - | - | - | - | - | - |
| CO3 | S | - | S | - | S | L | - | - | - | S | S | S |
| CO4 | S | - | S | - | S | L | - | - | - | S | S | S |
| CO5 | S | - | S | - | S | L | - | - | - | S | S | S |

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

**Title of the Course : DOT NET TECHNOLOGIES LAB**

**Category of the Course : ELECTIVE 2**

**Course Code : P1R3CAEC1:4P**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA :** 40 + **Ext:** 60 = 100 **Hrs/Week: 05**

**Credit: 03** **Total Inst. Hours: 75**

**COURSE OBJECTIVES:**

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

**List of Practicals:**

**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 OUTCOME (S):**

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

| | | |
|---|---|---|
| CO1: | Comprehend the overloading and method overriding | K1-K6 |
| CO2: | Understand the concept of classes and objects | K1-K6 |
| CO3: | Understand the concept of Inheritance | K1-K6 |
| CO4: | Understand the concept of Exceptions | K1-K6 |
| CO5: | Understand the concept of ASP.Net | K1-K6 |

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

**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

| COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | - | L | - | - | - | - | - | - |
| CO2 | S | - | M | - | M | L | - | - | - | - | - | - |
| CO3 | S | - | S | - | S | L | - | - | - | S | S | S |
| CO4 | S | - | S | - | S | L | - | - | - | S | S | S |
| CO5 | S | - | S | - | S | L | - | - | - | S | S | S |

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

J.J.College of Arts and Science (Autonomous)

Department of Computer Applications

Course Structure Based on TANSCHE and UGC - LOCF
(Choice Based Credit System)

(Applicable for the Candidates admitted from the Academic year 2023 - 2024 Onwards)

**M.C.A. - Semester II**

| Sl.No. | Course Code | Course | Overall Credits | Total Contact Hours/Week | Marks | | |
|---|---|---|---|---|---|---|---|
| | | | | | CIA | ESE | Total |
| **Semester II** | | | | | | | |
| 1 | P2R3CACC4 | Data Structures and Algorithms | 5 | 6 | 25 | 75 | 100 |
| 2 | P2R3CACC5 | Big Data Analytics | 5 | 6 | 25 | 75 | 100 |
| 3 | P2R3CACC6P | Practical II - (Data Structures and Algorithms & Big Data Analytics Lab) | 4 | 6 | 40 | 60 | 100 |
| 4 | P2R3CADSE 3:1 / 3:2 | Software Development Technologies / Soft Computing | 3 | 5 | 25 | 75 | 100 |
| 5 | P2R3CADSE 4:1 / 4:2 | Social Networks / High Performance Computing | 3 | 5 | 25 | 75 | 100 |
| 6 | P2R3CASEC 1:1 / 1:2 | Internet of Things / Computer Vision | 2 | 2 | 25 | 75 | 100 |
| | | **Total** | **22** | **30** | | | **600** |

**Title of the Course : Data Structures and Algorithms**

**Category of the Course : CORE COURSE**

**Course Code : P2R3CACC4**

**Nature of the Course : SKILL DEVELOPMENT**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 06**

**Credit: 05** **Total Inst. Hours: 90**

**Course Objectives:**

- To get a clear understanding of various ADT structures
- To understand how to implement the concept of Recursion and Arrays
- 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: Introduction to Data Structures and Algorithms (Inst. Hours: 18)**

**Introduction to Data Structures** –Elementary of Data organization- Classification of Data Structures- Operation on Data Structures - Abstract Data Types - Experimental Studies-The Seven Functions in Analysis of Algorithms

**UNIT II: Recursion and Arrays (Inst. Hours: 18)**

**Recursion:** Illustrative Examples-Factorial-Binary search file system-The Towers of Hanoi - Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

**Array based sequences:** Python sequence types-lower level Arrays-Dynamic Arrays

**UNIT III: Stacks, Queues, and Deques and Linked List (Inst. Hours: 18)**

**Stacks, Queues, and Deques:** Stacks-Stacks-Array based stack implementation- Queues ADT-Array based Queue Implementation- Double-Ended Queues -**Linked Lists:** Singly Linked Lists-Doubly Linked Lists.

**UNIT IV: Trees and Graphs (Inst. Hours: 20)**

**Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms –Binary search trees- **Graph Algorithms:** Graphs - Data Structures for Graphs-Graph Traversals-Depth First

Search-Breadth First Search

**UNIT V: Sorting Algorithms:** **(Inst. Hours: 16)**

**Sorting Algorithms:** Merge sort-Quick sort –sorting with priority queue-selection sort-insertion sort-heap sort.

**Text book:**

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013. (Unit – 1, 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 Outcome:**

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 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | L | L | L | S | S | S | L | M | M |
| CO2 | S | M | S | M | M | L | L | L | L | L | M | M |
| CO3 | S | S | S | L | L | L | M | M | M | M | M | L |
| CO4 | S | S | S | L | L | L | M | M | M | L | L | L |
| CO5 | S | S | S | L | M | M | S | S | S | S | M | L |

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

**Title of the Course : Big Data Analytics**

**Category of the Course : CORE COURSE**

**Course Code : P2R3CACC5**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 06**

**Credit: 05** **Total Inst. Hours: 90**

**Course Objectives**

- To introduce big data tools & Information Standard formats
- To understand the basic concepts of big data
- To learn Hadoop, HDFS and MapReduce concepts
- To teach the importance of No SQL
- To explore the big data tools such as Hive, HBase and Pig

**UNIT I:** **(Inst. Hours: 18)**

**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:** **(Inst. Hours: 18)**

**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:** **(Inst. Hours: 18)**

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

MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

**UNIT IV:** **(Inst. Hours: 18)**

**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:** **(Inst. Hours: 18)**

**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 MapReduce, 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 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | - | - | - | L | - | - | - | - | - | - |
| CO2 | S | - | M | - | M | L | - | - | - | - | - | - |
| CO3 | S | - | S | - | S | L | - | - | - | S | S | S |
| CO4 | S | - | S | - | S | L | - | - | - | S | S | S |
| CO5 | S | - | S | - | S | L | - | - | - | S | S | S |

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

**Title of the Course : Data Structures and Algorithms & Big Data Analytics Lab**

**Category of the Course : CORE COURSE**

**Course Code : P2R3CACC6P**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA : 40 + Ext : 60 = 100** **Hours/Week : 06**

**Credit: 04** **Total Inst. Hours: 90**

**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

**List of Programs – Data Structures and Algorithms - Use Python**

1. Stack ADT.
2. Quick sort.
3. Binary Search Tree.

**List of Programs – Big Data Analytics**

4. Implement File System Shell Commands for HDFS in Hadoop Environment
5. Write a Mapreduce program using single reduce function for finding Maximum and Minimum Number
6. Write a Mapreduce program using multiple reduce function for Word Count in an given Text document
7. Implement the following using Pig Latin Input and Output Operations Relational Operations
8. Implement the following using Pig Latin User Defined Functions Advanced Relational Operations
9. Write a Word Count program using Pig Latin Script
10. Write a program to find a maximum temperature using Pig Latin Script

**Course Outcomes**

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

| | | |
|---|---|---|
| CO1: | Understand and develop conceptually how Big Data is stored and implement it using different tools | **K1-K6** |
| CO2: | Comprehend and implement programs for data storage in HDFS and table manipulation using Big Data tools in Hadoop environment | **K1-K6** |
| CO3: | Understand and Critically analyse existing Big Data datasets and implementations the solutions for it using MongoDB | **K1- K6** |
| CO4: | Understand and examine existing Big Data datasets and implementations the solutions using HIVE database | **K1- K6** |
| CO5: | Comprehend and review existing datasets and implementations the solutions to handle it using PIG | **K1- K6** |

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

**Mapping with Programme Outcomes**

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

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

**Title of the Course : SOFTWARE DEVELOPMENT TECHNOLOGIES**

**Category of the Course : DISCIPLINE SPECIFIC ELECTIVE**

**Course Code : P2R3CADSE 3:1**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 05**

**Credit: 03** **Total Inst. Hours: 75**

**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:** **(Inst. Hours: 15)**

**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.

**UNIT II:** **(Inst. Hours: 15)**

**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.

**UNIT III:** **(Inst. Hours: 15)**

**.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.

**UNIT IV:** **(Inst. Hours: 15)**

**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.

**UNIT V:** **(Inst. Hours: 15)**

**Deploying the release**: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.

**Text Book**


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.


**Reference Books**


1. Karl Matthias and Sean P. Kane, Docker: Up and Running, O'Reilly Publication, Second Edition 2018.
2. Len Bass,IngoWeber,LimingZhu,"DevOps, A Software Architects Perspective", AddisonWesley-Pearson Publication, First Ediiton 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, analyse 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,**

**K 6 - Create**

**Mapping with Programme Outcomes**

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

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

**Title of the Course : SOFT COMPUTING**

**Category of the Course : DISCIPLINE SPECIFIC ELECTIVE**

**Course Code : P2R3CADSE 3:2**

**Nature of the Course : SKILL DEVELOPMENT**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 05**

**Credit: 03** **Total Inst. Hours: 75**

**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:** **(Inst. Hours: 15)**

**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:** **(Inst. Hours: 15)**

**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:** **(Inst. Hours: 15)**

**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 AutoAssociative Memory-Kohonen Self-Organizing Feature Map- Architecture-Flowchart for Training Process-Training Algorithm.

**UNIT IV:** **(Inst. Hours: 15)**

**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:** **(Inst. Hours: 15)**

**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.

**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** |
| **CO2** | To get familiar with Neural network architectures and supervised learning algorithms | **K3** |
| **CO3** | To understand the architectures and algorithms of Unsupervised Learning techniques | **K3-K4** |
| **CO4** | Develop the skills to gain a basic understanding of fuzzy logic theory and fuzzy inference systems | **K4** |
| **CO5** | Ability to learn traditional optimization and search techniques and genetic programming | **K5** |

**MAPPING WITH PROGRAMME OUTCOMES**

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

**S- STRONG; M-MEDIUM; L-LOW**

**Title of the Course : SOCIAL NETWORKS**

**Category of the Course : DISCIPLINE SPECIFIC ELECTIVE**

**Course Code : P2R3CADSE 4:1**

**Nature of the Course : EMPLOYABILITY**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 05**

**Credit: 03** **Total Inst. Hours: 75**

**Course Objectives**

- To learn about Social media, Social networking and Webcasts
- To understanding and building a Word Press Powered Website
- To analysis the Social Networking & Micro-Blogging
- To learn and analysis the Widgets & Badges
- To explore the importance of Website optimization

**UNIT I**: **(Inst. Hours: 16)**

Introduction: Social Media Strategy-Important First Decisions -Websites, Blogs - RSS Feeds Mapping -Preparation - Multimedia Items Gathering Content for Blog Posts RSS Feeds & Blogs-RSS Feeds-The Feed Reader-The Feed-Options for Creating an RSS Feed-Planning Feed-Blogs-Options for Starting. Blog and RSS Feed-Feed or Blog Content-Search Engine Optimization (SEO)-Feed Burner-RSS Feed and Blog Directories-An Optimization Plan for Blog or RSS Feed

**UNIT II:** **(Inst. Hours: 14)**

Building a Word Press Powered Website: Word Press as A CMS - Diversity of Word Press Sites-The Anatomy of a Word Press Site. Podcasting, Vidcasting, & Webcasting- Publishing Options for Podcast- Creating and Uploading Podcast Episodes-Publishing Podcast Optimizing Podcast-Webcasting.

**UNIT III:** **(Inst. Hours: 15)**

Social Networking & Micro-Blogging: Facebook-The Facebook Profile -Myspace LinkedIn-Twitter-Niche Social Networking Sites-Creating Own Social Network-Promoting Social Networking Presence- Social Bookmarking-A Social Bookmarking Strategy- Crowd-Sourced News Sites-Image Sharing Strategy-Video Sharing Sites-Video Sharing Strategy-Searching And Search Engine Placement-Connecting With Others.

**UNIT IV:** **(Inst. Hours: 18)**

Widgets & Badges: Highlighting Social Web Presence-Sharing And Syndicating Content Making Site More Interactive-Promoting Products And Making Money- Working Widgets Into Strategy Social Media Newsrooms-Building Social Media Newsroom - More Social Tools-Social Calendars-Social Pages Wikis-Social Search Portals-Virtual Worlds.

**Unit V:** **(Inst. Hours: 12)**

Website optimization: A Website Optimization Plan-Streamlining Web Presence-An Integration Plan- Looking to the Future-Life streaming: The Future of Blogging-Distributed Social Networking-Social Ranking, Relevancy, and ―Defriending.

**Text Book:**


1. Deltina hay ―A Survival Guide To social Media and Web 2.0 Optimization‖, Dalton Publishing, 2009


**Reference Books:**


1. Miriam Salpeter ―Social Networking for Career Success‖ Learning Express, 2011.
2. Miles, Peggy, ―Internet world guide to webcasting‖ Wiley, 2008
   Professionals", Wiley Publication,2015.


**Course Outcomes**

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

| | | |
|---|---|---|
| CO1: | To understand, impart and summarize the concepts of Social media, Social networking and Webcasts | **K1-K6** |
| CO2: | To comprehend, design and develop a Word Press Powered Website | **K1-K6** |
| CO3: | To understand, implement and perform evaluation of Social Networking and Micro-Blogging | **K1-K6** |
| CO4 | To collaborate, implement and analyse the Widgets and Badges in social networking environment | **K1-K6** |
| CO5 | To understand, illustrate and perform evaluation of web optimization for social networks | **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 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | - | S | L | - | S | - | S | S | S |
| CO2 | S | S | S | - | S | L | - | S | - | S | S | S |
| CO3 | S | S | S | - | S | L | - | S | - | S | S | S |
| CO4 | S | S | S | - | S | L | - | S | - | S | S | S |
| CO5 | S | S | S | - | S | L | - | S | - | S | S | S |

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

**Title of the Course : HIGH PERFORMANCE COMPUTING**

**Category of the Course : DISCIPLINE SPECIFIC ELECTIVE**

**Course Code : P2R3CADSE 4:2**

**Nature of the Course : SKILL DEVELOPMENT**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 05**

**Credit: 03** **Total Inst. Hours : 75**

**Course Objectives:**

- To get a clear idea of High Performance Computing concept
- To get brief knowledge about how to function the HPC systems
- To get idea of what techniques used in HPC models
- To understand a Parallel computing concepts
- To get familiar with OpenMP technology that is widely used in HPC technology

**UNIT I:** **(Inst. Hours: 15)**

**Modern processors:** Stored-program computer architecture-General purpose cache based microprocessor architecture-Memory hierarchies-Multicore processors-Multithreaded processors-Vector processors. **Basic optimization techniques for serial code:** Scalar profiling-Common sense optimizations-Simple measures, large impact-The role of compilers-C++ optimizations.

**UNIT II:** **(Inst. Hours: 15)**

**Data access optimization:** Balance analysis and light speed estimates-Storage order-Algorithm classification and access optimizations-The Jacobi algorithm-Algorithm classification and access optimizations-Sparse matrix-vector multiply. **Parallel computers:** Taxonomy of parallel computing paradigms-Shared-memory computers-Distributed memory computers-Hierarchical systems-Networks.

**UNIT III:** **(Inst. Hours: 15)**

**Basics of parallelization:** Introduction to Parallelism -Parallel scalability. **Shared memory parallel programming with OpenMP:** Short introduction to OpenMP-OpenMP-parallel Jacobi algorithm.

**UNIT IV:** **(Inst. Hours: 15)**

**Efficient OpenMP programming:** Profiling OpenMP programs-Performance pitfalls-Parallel sparse matrix-vector multiply. **Locality optimizations on ccNUMA architectures:** Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls-ccNUMA issues with C++.

**UNIT V:** **(Inst. Hours: 15)**

**Distributed-memory parallel programming with MPI:** Message passing-A short introduction to MPI-MPI parallelization of a Jacobi solver. **Efficient MPI programming:** MPI performance tools-Communication parameters-Synchronization, serialization, contention-Reducing communication overhead-Understanding intranode point-to-point communication.

**Text book:**

1. Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011.**Chapters:** 1 to 10.

**Reference books:**

1. Michael W. Berry, Kyle A. Gallivan, EfstratiosGallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
2. Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.

**Course Outcome:**

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

| | | |
|---|---|---|
| CO1 | Understand of the HPC and ccNUMA concepts | **K1 - K6** |
| CO2 | Design and develop a parallel programming with modern C, C++ and new version of FORTRAN | |
| CO3 | Apply with parallel computing | |
| CO4 | Develop an efficient OpenMP programming | |
| CO5 | Evaluate an efficient MPI programming | |

**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 | L | M | L | L | L | S | S | S | S | M | L |
| CO2 | S | M | L | M | M | L | S | L | S | L | S | L |
| CO3 | S | S | S | M | M | L | M | L | M | L | S | L |
| CO4 | S | S | S | M | S | L | M | L | M | S | S | S |
| CO5 | S | S | S | M | M | L | M | M | M | M | S | L |

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

**Title of the Course** : **INTERNET OF THINGS**

**Category of the Course** : **SKILL ENHANCEMENT COURSE**

**Course Code** : **P2R3CASEC 1:1**

**Nature of the Course** : **EMPLOYABILITY**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 02**

**Credit: 02** **Total Inst. Hours: 30**

**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** **(Inst. Hours: 06)**

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** **(Inst. Hours: 06)**

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.

**UNIT III: DESIGN AND DEVELOPMENT** **(Inst. Hours: 06)**

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.

**UNIT IV:** **(Inst. Hours: 06)**

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:** **(Inst. Hours: 06)**

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.

**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 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | M | S | S | S | S | S | S | S | S | S |
| CO2 | S | S | S | S | S | S | S | M | S | S | M | S |
| CO3 | S | M | S | S | S | S | M | S | S | M | S | S |
| CO4 | S | S | S | S | 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**

**Title of the Course** : **COMPUTER VISION**

**Category of the Course** : **SKILL ENHANCMENT COURSE**

**Course Code** : **P2R3CASEC 1:2**

**Nature of the Course** : **EMPLOYABILITY**

**Max.Marks: CIA : 25 + Ext : 75 = 100** **Hours/Week : 02**

**Credit: 02** **Total Inst. Hours: 30**

**Course Objectives:**

- To get understanding about Computer vision techniques behind a wide variety of real- world applications.
- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
- To get an idea of how to build a computer vision application with Python language.
- To understand various machine learning techniques that are used in computer vision tasks.
- To incorporate machine learning techniques with computer vision systems.

**Unit-I** **(Inst. Hours: 06)**

**Basic Image Handling and Processing:** PIL – the Python Imaging Library-Matplotlib-NumPy-SciPy-Advanced example: Image de-noising. **Local Image Descriptors:** Harris corner detector-SIFT - Scale-Invariant Feature Transform-Matching Geotagged Images.

**Unit-II** **(Inst. Hours: 06)**

**Image to Image Mappings:** Homo graphies - Warping images - Creating Panoramas. **Camera Models and Augmented Reality:** The Pin-hole Camera Model - Camera Calibration - Pose Estimation from Planes and Markers - Augmented Reality.

**Unit-III** **(Inst. Hours: 06)**

**Multiple View Geometry:** Epipolar Geometry - Computing with Cameras and 3D Structure - Multiple View Reconstruction - Stereo Images. **Clustering Images:** K - means Clustering-Hierarchical Clustering - Spectral Clustering.

**Unit-IV** **(Inst. Hours: 06)**

**Searching Images:** Content based Image Retrieval - Visual Words - Indexing Images - Searching the Database for Images - Ranking Results using Geometry - Building Demos and Web Applications. **Classifying Image Content:** K- Nearest Neighbors - Bayes Classifier - Support Vector Machines - Optical Character Recognition.

**Unit-V** **(Inst. Hours: 06)**

**Image Segmentation:** Graph Cuts - Segmentation using Clustering - Variational Methods. **OpenCV:** Python Interface – Open CV Basics - Processing Video - Tracking.

**Course Outcome:**

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

| | | |
|---|---|---|
| CO1 | To understand and recall computer vision and its application areas | K1-K6 |
| CO2 | To develop build a computer vision system | |
| CO3 | To apply and analyze a design range of algorithms for image processing and computer vision | |
| CO4 | To develop incorporate machine learning techniques with computer vision system | |
| CO5 | To apply and analyze image segmentation and image registration | |

**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 | L | M | L | L | L | M | M | M | S | S | L |
| CO2 | S | M | L | M | M | L | S | L | S | L | S | L |
| CO3 | S | S | S | M | M | L | M | L | M | L | M | L |
| CO4 | S | S | S | M | M | L | M | L | M | L | S | L |
| CO5 | S | S | S | M | M | L | S | L | S | L | S | L |

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