



BON SECOURS COLLEGE FOR WOMEN (AUTONOMOUS)

Accredited with 'A++' Grade by NAAC in Cycle II
Affiliated to Bharathidasan University, Tiruchirappalli
UGC Recognized 2(f) and 12(B) Institution
Vilar Bypass, Thanjavur – 613 006

DEPARTMENT OF COMPUTER SCIENCE

M. Sc., Computer science

SEMESTER I

Core Theory 1 : MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

COURSECODE: 24PCS101

Contact Hours/Week: 5

Credits: 4

Internal marks : 25

External marks: 75

Syllabus

UNIT - I MATRICES:

Determinants, inverse of matrix. System of equations, Linear transformation - rank and nullity, Consistency and inconsistency of linear system of equations, rank nullity theorem, Echelon form of a matrix, and Row reduced echelon form of matrix. Eigen values and Eigen vectors.

UNIT – II POWER METHOD TO FIND THE DOMINANT EIGEN VALUES, NUMERICAL LINEAR ALGEBRA:

Gauss elimination method, Gauss Jordan Method, Jacobi Method for solving linear systems.

UNIT – III SETS:

Operations on sets, Venn Diagrams, Multi Sets, Binary Relations, Equivalence Relations, Ordering Relations, Operations on Relations, Partial Orders . Statements and Notation, Connectives, Quantified Propositions, Logical Inferences, Methods of Proof of an Implication, First Order Logic and other Methods of Proof, Rules of Inference for Quantified Propositions, Proof by Mathematical Induction.

UNIT – IV GENERATING FUNCTIONS OF SEQUENCES:

Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, the Method of Characteristic Roots, Solutions of Inhomogeneous Recurrence Relations

UNIT – V INTRODUCTION TO PROBABILITY:

Random variables - discrete and continuous, probability functions, density and distribution functions, mean and variance, special distributions (Binomial, Hyper geometric, Poisson, Uniform, exponential and normal). Testing of Hypothesis, Null and alternative hypothesis, level of significance, one-tailed and two tailed tests, tests for small samples- T-test, Chi-square test.

Text Book:

1. Kenneth H. Rosen, *"Discrete Mathematics and Its Applications"*, McGraw-Hill Education, 8th Edition, 2019.

Reference Books:

1. Gilbert Strang, *"Introduction to Linear Algebra"*, Wellesley-Cambridge Press, 5th Edition, 2016.
2. Seymour Lipschutz and Marc Lipson, *"Schaum's Outline of Linear Algebra"*, McGraw-Hill Education, 6th Edition, 2018.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *"Numerical Methods for Scientific and Engineering Computation"*, New Age International Publishers, 7th Edition, 2019.
4. Richard L. Burden and J. Douglas Faires, *"Numerical Analysis"*, Cengage Learning, 10th Edition, 2015.
5. S.C. Gupta and V.K. Kapoor, *"Fundamentals of Mathematical Statistics"*, Sultan Chand & Sons, 12th Edition, 2020.
6. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, *"Probability and Statistics for Engineers and Scientists"*, Pearson Education, 9th Edition, 2017.

Reference Links:

1. MIT OpenCourseWare – Linear Algebra
[MIT OpenCourseWare – Linear Algebra](#)
2. NPTEL – Discrete Mathematics
[NPTEL – Discrete Mathematics](#)
3. NPTEL – Numerical Methods
[NPTEL – Numerical Methods](#)
4. OpenStax – Introductory Statistics
[OpenStax – Introductory Statistics](#)
5. Khan Academy – Linear Algebra and Probability
[Khan Academy](#)
6. This format matches the style of your sample and avoids repeating syllabus content.

Core Courses -II: DESIGN AND ANALYSIS OF ALGORITHM

Course code: 24PCS102

Contact Hours/Week: 5

Internal marks : 25

Credits: 4

External marks: 75

Syllabus

Unit – I

Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity- Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heapsort- Graph.

Unit – II

Basic Traversal and Search Techniques: Techniques for Binary Trees-Techniques for Graphs -Divide and Conquer: - General Method – Defective Chessboard - Binary Search – Finding the maximum and minimum - Merge Sort – Quick Sort.

Unit – III

The Greedy Method: General Method–Container loading - Knapsack Problem – Tree vertex splitting - Job Sequence with deadlines –Minimum Cost Spanning Tree– Optimal Merge Patterns - Single Source Shortest Path.

Unit – IV

Dynamic Programming-General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Travelling Salesperson Problem – Flow Shop Scheduling.

Unit – V

Backtracking:-General Method–8-Queens Problem–Sum of Subsets–Graph Coloring– Hamiltonian Cycles – Knapsack problem - Branch and Bound: The Method – 0/1 Knapsack problem.

Text Book:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, *"Fundamentals of Computer Algorithms"*, Universities Press, 2nd Edition, 2008.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to Algorithms"*, MIT Press, 4th Edition, 2022.
2. Anany Levitin, *"Introduction to the Design and Analysis of Algorithms"*, Pearson Education, 4th Edition, 2020.
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, *"The Design and Analysis of Computer Algorithms"*, Pearson Education, 1st Edition, 2007.
4. Sara Baase and Allen Van Gelder, *"Computer Algorithms: Introduction to Design and Analysis"*, Pearson Education, 3rd Edition, 2000.
5. Steven S. Skiena, *"The Algorithm Design Manual"*, Springer, 3rd Edition, 2020.
6. Jon Kleinberg and Éva Tardos, *"Algorithm Design"*, Pearson Education, 1st Edition, 2005.

Reference Links:

1. Introduction to Algorithms – MIT OpenCourseWare
[MIT OpenCourseWare – Introduction to Algorithms](#)
2. NPTEL – Design and Analysis of Algorithms
[NPTEL – Design and Analysis of Algorithms](#)
3. Stanford Algorithms Course
[Stanford Algorithms Course](#)
4. GeeksforGeeks – Data Structures and Algorithms
[GeeksforGeeks – Data Structures and Algorithms](#)
5. Visualgo – Algorithm Visualization
[Visualgo](#)
6. Khan Academy – Algorithms
[Khan Academy – Algorithms](#)

Core Courses-III: PYTHON AND R PROGRAMMING

Course code : -24PCS103

Contact Hours/Week: 5

Internal marks : 25

Credits: 4

External marks: 75

SYLLABUS

UNIT-1 INTRODUCTION TO PYTHON & CODE STRUCTURE

Introduction–Python overview–Numbers – Strings – Variables – Lists – Tuples – Dictionaries – Sets – Comparison. – : if, elif, and else – Repeat with while – Iterate with for– Functions – Generators – Decorators – Namespaces and Scope –Standard datatypes– Operators–Statements and Expressions–String operations - Boolean expressions. Control Statements: The for loop–while statement–if-elif-else statement– Input from keyboard. Functions: Introduction–Built-in functions–User defined functions– Function Definition–Function Call–Type conversion–Type coercion–Python recursive function.

UNIT-II STRINGS, MODULES, PACKAGES, AND PROGRAMS

Strings–len function– Strings slices– String traversal –Escape characters–String formatting operator–String formatting functions. Tuples: Tuples–Creating tuples– Accessing values in tuples–Basic tuple operations–Built-in tuple functions. Lists: Values and accessing elements – Traversing a list – Deleting elements from list–Built-in list operators & methods. Dictionaries: Creating dictionary–Accessing values in dictionary – Updating dictionary —Operations in dictionary Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. Objects and Classes: Define a Class with class – Inheritance – Override a Method – Add a Method — Method Types – Duck Typing – Special Methods – Composition.

UNIT-III DATA TYPES, FILES AND EXCEPTIONS:

Data Types: Text Strings – Binary Data. Storing and Retrieving Data: File Input/Output – Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores. Web: Web Clients – Web Servers – Web Services and Automation. Introduction to File Input and Output- Writing Structures to a File- Using loops to process files Processing Records- Exception. Classes and Objects in Python: Overview of OOP–Data encapsulation– Polymorphism – Class definition –Creating objects – Inheritance – Multiple inheritances – Method overriding – Data encapsulation–Data hiding.

UNIT–IV DATAMANIPULATION TOOLS & SOFTWARES:

Numpy: Installation - N-darray - Basic Operations - Indexing, Slicing, and Iterating - Shape Manipulation - Array Manipulation - Structured Arrays - Reading and Writing Array Data on Files. Pandas: The pandas Library: An Introduction - Installation - Introduction to pandas Data Structures - Operations between Data Structures - Function Application and Mapping - Sorting and Ranking - Correlation and Covariance - —Not a Number Data - Hierarchical Indexing and Leveling - Reading and Writing Data: CSV or Text File - HTML Files Excel Files.

UNIT–V PROGRAMMING WITH R:

Variables - Vector, matrix, arrays - List - Data Frames - Functions - Strings - Factors - Loops - Packages - Date and Time - Files - Making packages

Text Book:

1. Mark Lutz, *"Learning Python"*, O'Reilly Media, 5th Edition, 2013.

Reference Books:

1. Eric Matthes, *"Python Crash Course: A Hands-On, Project-Based Introduction to Programming"*, No Starch Press, 3rd Edition, 2023.
2. Allen B. Downey, *"Think Python: How to Think Like a Computer Scientist"*, O'Reilly Media, 2nd Edition, 2016.
3. Luciano Ramalho, *"Fluent Python"*, O'Reilly Media, 2nd Edition, 2022.
4. Wes McKinney, *"Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter"*, O'Reilly Media, 3rd Edition, 2022.
5. Hadley Wickham and Garrett Grolemund, *"R for Data Science"*, O'Reilly Media, 2nd Edition, 2023.
6. Norman Matloff, *"The Art of R Programming"*, No Starch Press, 1st Edition, 2011.

Reference Links:

1. Python Official Documentation
[Python Documentation](#)
2. NumPy Official Documentation
[NumPy Documentation](#)
3. Pandas Official Documentation
[Pandas Documentation](#)

Core Laboratory–I: DESIGN AND ANALYSIS OF ALGORITHM LAB
COURSECODE:24PCS301

Credits: 2

Contact Hours/Week: 4

Internal marks : 40

External marks: 60

Syllabus:

1. Implement Selection sort and find how many steps are required to sort 10 elements.
2. Implement and Analysis factorial of a number program using iterative and recursive methods.
3. Implement Insertion Sort and analyse the time complexity.
4. Given two strings, find the minimum number of edits required to convert one string to another.
5. Write a program to find the Greatest Common Divisor of two numbers using recursion and find how many steps are required to execute it.
6. Apply Greedy method to compress the given data using Huffman encoding.
7. Implement fractional knapsack problem using Greedy Strategy.
8. Implement minimum spanning tree using Prim's algorithm and analyse its time complexity.
9. Apply dynamic programming methodology to implement 0/1 Knapsack problem.
10. Solve the longest common subsequence problem using dynamic programming

Core Laboratory–II: PYTHON AND R PROGRAMMING LAB
COURSECODE:24PCS302

Credits : 2
Contact Hours/Week: 4

Internal marks : 40
External marks: 60

Syllabus:

(a). Implement the following concepts using Python

1. Decision Making and Looping statements.
2. Function Definition & Function call.
3. Create and Access Lists.
4. Built-In Tuple Functions.
5. Create and Access Dictionaries.
6. Files and Exceptions.

(b). Implement the following concepts using R

1. Loops with different examples.
2. Implement data frames in R.
3. Implement different data structures in R (Vectors, Lists, Data Frames)
4. Write a program to read a csv file and analyze the data in the file
5. Create pie charts and bar charts using R.

Elective Theory 1 : ADVANCED JAVA PROGRAMMING
COURSECODE:24PCS201

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

SYLLABUS

UNIT I:Introduction

Review of Object Oriented concepts – History of Java – Java buzz words – JVM architecture - Data types - Variables - Scope and life time of variables - arrays - operators – control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data – Static Method String and String Buffer Classes.

UNIT II: Inheritance

Inheritance: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. Packages: Definition-Access Protection -Importing Packages. Interfaces: Definition–Implementation–Extending Interfaces. Exception Handling: try – catch- throw - throws – finally – Built-in exceptions - Creating own Exception classes.

UNIT III:Multithreaded Programming

Multithreaded Programming: Thread Class - Runnable interface –Synchronization–Using synchronized methods– Using synchronized statement- Inter thread Communication –Deadlock. I/O Streams: Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling

UNIT IV :AWT Controls

AWT Controls: The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.Event Handling: Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes.

UNIT V :Swing

Introduction to Swing - Hierarchy of swing components. Containers - Top level containers – J Frame – J Window – J Dialog – J Panel – J Button – J toggle Button – J Check Box – J Radio Button – J Label, J Text Field – J Text Area – J List – J Combo Box – J Scroll Pane. JDBC :Programming JDBC Architecture, Types of JDBC Drivers.

Text Book:

1. Herbert Schildt, "*Java: The Complete Reference*", McGraw-Hill Education, 12th Edition, 2021.

Reference Books:

1. E. Balagurusamy, "*Programming with Java: A Primer*", McGraw-Hill Education, 6th Edition, 2019.
2. Kathy Sierra and Bert Bates, "*Head First Java*", O'Reilly Media, 3rd Edition, 2022.
3. Paul Deitel and Harvey Deitel, "*Java: How to Program*", Pearson Education, 11th Edition, 2018.
4. Cay S. Horstmann, "*Core Java Volume I – Fundamentals*", Pearson Education, 12th Edition, 2021.

5. Bruce Eckel, *"Thinking in Java"*, Prentice Hall, 4th Edition, 2006.
6. Y. Daniel Liang, *"Introduction to Java Programming and Data Structures"*, Pearson Education, 12th Edition, 2019.

Reference Links:

1. Java Official Documentation
[Java Documentation](#)
2. Oracle Java Tutorials
[Oracle Java Tutorials](#)
3. OpenJDK Documentation
[OpenJDK Documentation](#)
4. NPTEL – Programming in Java
[NPTEL Programming in Java](#)
5. GeeksforGeeks – Java Programming
[GeeksforGeeks Java Tutorials](#)
6. JavaTPoint – Java Tutorial
JavaTPoint Java Tutorial

Elective Theory I : DEVOPS
COURSECODE:24PCS204

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus

UNIT I: INTRODUCTION

Phases of Software -Development life cycle- Values and principles of agile- software development.

UNIT – II: FUNDAMENTALS OF DEVOPS

Fundamentals of Devops – Architecture – Deployments – Orchestration –NeedInstance of applications -Devops delivery pipeline - Devops eco system.

UNIT III: DEVOPS ADOPTION IN PROJECTS

Devops adoption in projects - Technology aspects - Agiling capabilities - Tool stack implementation - People aspect, processes.

UNIT IV: INTRODUCTION TO CI/CD

CI/CD - Introduction to Continuous Integration - Continuous Delivery and Deployment -Benefits of CI/CD - Metrics to track CICD practices.

UNIT V: DEVOPS MATURITY MODEL

Devops Maturity Model - Key factors of Devops maturity model - stages of Devops maturity model -Devops maturity Assessment.

Text Book:

1. Gene Kim, Jez Humble, Patrick Debois and John Willis, *"The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations"*, IT Revolution Press, 2nd Edition, 2021.

Reference Books:

1. Jez Humble and David Farley, *"Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation"*, Addison-Wesley Professional, 1st Edition, 2010.
2. Nicole Forsgren, Jez Humble and Gene Kim, *"Accelerate: The Science of Lean Software and DevOps"*, IT Revolution Press, 1st Edition, 2018.
3. Len Bass, Ingo Weber and Liming Zhu, *"DevOps: A Software Architect's Perspective"*, Addison-Wesley Professional, 1st Edition, 2015.
4. Joakim Verona, *"Practical DevOps"*, Packt Publishing, 2nd Edition, 2018.
5. Viktor Farcic and Alex Garcia, *"The DevOps 2.0 Toolkit"*, CreateSpace Independent Publishing, 1st Edition, 2016.
6. Michael Huttermann, *"DevOps for Developers"*, Apress, 1st Edition, 2012.

Reference Links:

1. DevOps Institute
[DevOps Institute](#)
2. Atlassian DevOps Resources
[Atlassian DevOps Guide](#)
3. AWS DevOps Documentation
[AWS DevOps Documentation](#)
4. Microsoft Azure DevOps Documentation
Azure DevOps Documentation
5. Red Hat DevOps Resources
[Red Hat DevOps Resources](#)
6. NPTEL – Software Engineering and DevOps Concepts
[NPTEL Courses](#)

Elective Theory 1 : FUNDAMENTALS OF INTERNET OF THINGS
COURSECODE:24PCS207

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

SYLLABUS

UNIT I: Introduction to Internet of Things

Overview: History, Definition and Characteristics, Connectivity Terminologies, Building blocks, IoT Architecture, Various Platforms for IoT, Issues in IoT and solutions, Real time Examples of IoT, Challenges in IoT Recent Trends in the Adoption of IoT, Role of Cloud in IoT,

UNIT II: Applications of Internet of Things

Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection. Health Care, Smart Transportation, Smart Living, Smart Cities, Smart Grid. Interfacing: Interfacing Input, Intermediate, Output and Display Sensors, Converters, Actuators, Controlling Hardware, Controllers and Network Devices,

UNIT III: Internet of Thing and M2M

IoT& M2M Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, IoT& M2M Machine to Machine, Difference between IoT and M2M, Software define Network

UNIT IV: Internet of Thing Protocols

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – Security.

UNIT V: Sensors Networks & IoT Connectivity Principles

Sensors Definition, Types of Sensors, Examples and Working, IoT Development Boards. Wireless Sensor Networks: History, node, Connecting nodes, Networking Nodes, WSN and IoT. Web Connectivity for Connected Devices Network using Gateway - Internet Connectivity - Internet - Based Communication - IP Addressing in the IoT - Media Access Control - Application Layer Protocols: HTTP, HTTPS, ETP, Telnet and Others.

Text Book:

1. Arshdeep Bahga and Vijay Madisetti, *"Internet of Things: A Hands-On Approach"*, Universities Press, 1st Edition, 2015.

Reference Books:

1. Raj Kamal, *"Internet of Things: Architecture and Design Principles"*, McGraw Hill Education, 2nd Edition, 2017.
2. Vijay Madisetti and Arshdeep Bahga, *"Internet of Things (A Hands-On Approach)"*, VPT Publications, 1st Edition, 2014.
3. Samuel Greengard, *"The Internet of Things"*, MIT Press, 1st Edition, 2015.
4. Jeeva Jose, *"Internet of Things"*, Khanna Publishing House, 1st Edition, 2018.
5. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, *"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things"*, Cisco Press, 1st Edition, 2017.
6. Olivier Hersent, David Boswarthick and Omar Elloumi, *"The Internet of Things: Key Applications and Protocols"*, Wiley, 2nd Edition, 2012.

Reference Links:

1. IoT World Today
[IoT World Today](#)
2. Cisco IoT Resources
Cisco Internet of Things
3. IBM Internet of Things
[IBM Internet of Things](#)
4. NPTEL – Internet of Things
[NPTEL Internet of Things Course](#)
5. IoT For All
[IoT For All](#)
6. Eclipse IoT Documentation
[Eclipse IoT Documentation](#)

Elective Theory 1 : CROSS PLATFORM APPLICATION DEVELOPMENT USING FLUTTER

COURSECODE:24PCS210

Hours/Week: 5

Credits: 4

Internal marks : 25

External marks: 75

Syllabus:

Unit I:

Introduction to Flutter , Flutter – installation , Widgets, Gestures (Title , Body, Layouts, Columns, Root , Run App). The other options, Native solutions, What is Dart

Unit II :

Basics of Dart Keywords, built-in types, functions, operators, control flow statements, exceptions, classes, generics, libraries and visibility, asynchrony support, generators, callable classes, isolates, typedefs, metadata, comments Setting up Flutter development environment

Unit III :

The basics of writing Flutter code Hello World - Flutter App Basic Widgets such as AppBar, Column, Row, Container, Image, Icon, Buttons, Text, etc;

Unit IV :

Pushing pixels: Flutter Animation and Using the canvas - Painting to the canvas and details of using flutter animation -Flutter state management - Asnyc Dart and Flutter and Infinite Scrolling

Unit V

Working with SQLite Database - Making RESTful API Calls with HTTP - Architecting Large Flutter Application

Text Book:

1. Eric Windmill, *"Flutter in Action"*, Manning Publications, 1st Edition, 2020.

Reference Books:

1. Alberto Miola, *"Flutter Complete Reference"*, Independently Published, 1st Edition, 2021.
2. Carmine Zaccagnino, *"Beginning Flutter: A Hands-On Guide to App Development"*, Apress, 1st Edition, 2020.
3. Simone Alessandria, *"Flutter Projects"*, Packt Publishing, 2nd Edition, 2021.
4. Frank Zammetti, *"Practical Flutter: Improve Your Mobile Development with Google's Latest Open-Source SDK"*, Apress, 1st Edition, 2019.
5. Sanjib Sinha, *"Beginning Flutter with Dart"*, Apress, 2nd Edition, 2020.
6. Marco L. Napoli, *"Beginning Flutter: Build Mobile Apps with Dart 2 and Flutter"*, Wiley, 1st Edition, 2019.

Reference Links:

1. Flutter Official Documentation
[Flutter Documentation](#)
2. Dart Official Documentation
[Dart Documentation](#)
3. Flutter Codelabs
[Flutter Codelabs](#)

Elective Theory II : COMPUTER VISION
COURSECODE: 24PCS213

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus

UNIT I: Recognition Methodology:

Conditioning, Labeling, Grouping, Extracting, Matching. Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components.

UNIT II: Binary Machine Vision:

Thresholding, Segmentation, Connected component labeling, Hierarchical segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation.

UNIT III: Area Extraction:

Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting).

UNIT IV: Region Analysis:

Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.

UNIT V: Facet Model Recognition:

Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consistent labeling problem, Back-tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry from 2D to 3D, Image matching : Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching.

Text Book:

1. Ramesh Jain, Rangachar Kasturi and Brian G. Schunck, "*Machine Vision*", McGraw-Hill Education, 1st Edition, 1995.

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, "*Digital Image Processing*", Pearson Education, 4th Edition, 2018.
2. E. R. Davies, "*Machine Vision: Theory, Algorithms, Practicalities*", Academic Press, 5th Edition, 2017.
3. Milan Sonka, Vaclav Hlavac and Roger Boyle, "*Image Processing, Analysis, and Machine Vision*", Cengage Learning, 4th Edition, 2014.
4. Richard Szeliski, "*Computer Vision: Algorithms and Applications*", Springer, 2nd Edition, 2022.
5. Berthold Klaus Paul Horn, "*Robot Vision*", MIT Press, 1st Edition, 1986.
6. Mark Nixon and Alberto Aguado, "*Feature Extraction and Image Processing for Computer Vision*", Academic Press, 4th Edition, 2019.

Reference Links:

1. OpenCV Documentation
[OpenCV Documentation](#)
2. Computer Vision: Algorithms and Applications
[Computer Vision Book](#)
3. NPTEL – Computer Vision
[NPTEL Computer Vision Course](#)
4. OpenCV Tutorials
[OpenCV Tutorials](#)
5. MIT OpenCourseWare – Computer Vision
[MIT OpenCourseWare Computer Vision](#)
6. Stanford Computer Vision Resources
[Stanford Vision Lab](#)

Elective Theory II : ADVANCED OPERATING SYSTEM
COURSECODE:24PCS216

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus

UNIT I:

Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- memory management.

UNIT II:

Distributed Operating Systems: System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection

UNIT III:

Distributed Scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement - Caching

UNIT IV:

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms

UNIT V:

Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming – Runtime issues Approaches to power management

Text Book:

1. Mukesh Singhal and Niranjana G. Shivaratri, *"Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems"*, McGraw-Hill Education, 1st Edition, 1994.

Reference Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, *"Distributed Systems: Principles and Paradigms"*, Pearson Education, 2nd Edition, 2007.
2. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, *"Operating System Concepts"*, Wiley, 10th Edition, 2018.
3. Andrew S. Tanenbaum and Herbert Bos, *"Modern Operating Systems"*, Pearson Education, 4th Edition, 2015.

E-resources:

1. <https://www.geeksforgeeks.org/operating-systems/>
2. https://www.tutorialspoint.com/operating_system/index.htm
3. <https://www.guru99.com/operating-system-tutorial.html>

Elective Theory II : USER INTERFACE DESIGN DEVELOPMENT

COURSECODE:24PCS219

Hours/Week: 5

Internal marks : 25

Credits: 4

External marks: 75

Syllabus:

UNIT – I

HTML, XML, CSS& RWD: Introduction To HTML- DHTML , XML – Structuring XML document using DTD – Schemas – XML parsers – DOM – SAX presentation technologies – XSL – XFORMS – XHTML – Transformations – XSLT – XLINK – XPATH – XQuery. Responsive Web Design-Intro-Fluid Grid-Viewport-Media Queries-Images. Introduction ToCSSSyntax, Selectors-Types of style sheets.

UNIT – II CLIENT SIDE SCRIPTING:

Java Script – Advantages – Data types – Variables – Operators – Control statements – Functions – Objects and arrays – Windows and frames – Forms. AJAX – XML Http Request (XHR) – Create Object – Request – Response – Ready state.

UNIT – III SERVER SIDE SCRIPTING:

Introduction To PHP – Data Types – Control Structures – Arrays - Function – Html Form with PHP –Form Handling & Validation - File Handling – Cookies – Sessions – Filters – Exception Handling - Database Connectivity With MySQL.

UNIT – IV ANGULAR JS & JQUERY:

Angular JS Expression – Modules – Directives – Data Binding – Controllers – Scopes – Filters – Services – Tables – Events – Form – Validation. Query Syntax – Selects – Events – jQuery Effects – jQuery – jQuery HTML – jQuery Traversing.

UNIT – V UX & UI: UX

Introduction -Elements of UX Design- UX Design Process- Research Methods and Tools-Understanding User Needs and Goals. UX Design Process: Visual Design Principles-Information Design and Visualization-Interaction Design Prototyping Tools-Usability Test. UI Introduction-User Interface Components - Tools and Processes

Text Book:

1. Jeffrey C. Jackson, *"Web Technologies: A Computer Science Perspective"*, Pearson Education, 1st Edition, 2006.

Reference Books:

1. Jon Duckett, *"HTML and CSS: Design and Build Websites"*, Wiley, 1st Edition, 2011.
2. Jon Duckett, *"JavaScript and JQuery: Interactive Front-End Web Development"*, Wiley, 1st Edition, 2014.
3. Luke Welling and Laura Thomson, *"PHP and MySQL Web Development"*, Addison-Wesley Professional, 5th Edition, 2016.
4. Brad Green and Shyam Seshadri, *"AngularJS: Up and Running"*, O'Reilly Media, 1st Edition, 2013.
5. Russ Unger and Carolyn Chandler, *"A Project Guide to UX Design: For User Experience Designers in the Field or in the Making"*, New Riders, 3rd Edition, 2012.

E-resources:

1. <https://developer.mozilla.org/en-US/>
2. <https://www.w3schools.com/>
3. https://www.tutorialspoint.com/web_developers_guide.htm
4. <https://angular.io/docs>
5. <https://jquery.com/>
6. <https://www.php.net/docs.php>
7. <https://www.interaction-design.org/>

SEMESTER-II

Core - Theory IV

ADVANCED RELATIONAL AND DISTRIBUTED MANAGEMENT SYSTEM

COURSE CODE :24PCS104

Hours/Week: 5

Credits: 4

Internal marks : 25

External marks: 75

SYLLABUS

UNIT I INTRODUCTION TO DATABASE DESIGN

Entities, Attributes, Entity Sets, Relationships, Key Constraints, Participation Constraints, Weak Entities, UML Class Diagrams, Subclasses, Superclasses, Inheritance, Specialization, Generalization, Constraints and Characteristics of Specialization and Generalization Hierarchies, Modeling of UNION Types Using Categories, Representing Specialization and Generalization In UML Class Diagrams, Data Abstraction, Knowledge Representation and Ontology Concepts.

UNIT II DATABASES DESIGN THEORY

Problems Caused by Redundancy, Decompositions, Problems Related to Decomposition, Reasoning About FD's, FIRST, SECOND, THIRD Normal Form, BCNF, Fourth Normal Form, Lossless Join Decomposition, Dependency Preserving Decomposition, Schema Refinement in Database Design, Multi Valued Dependencies.

UNIT III OBJECT- ORIENTED, PARALLEL AND DISTRIBUTED DATABASES

Overview of Object-Oriented Concepts, Object Identity, Object Structure, Type Constructor, Encapsulation of operations, Methods and Persistence; Architectures for Parallel Databases, Parallel Query Evaluation, Parallelizing Individual Operations, Sorting Joins, Distributed Database Concepts, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Query Processing in Distributed Databases, Concurrency Control and Recovery in Distributed Databases.

UNIT IV DATABASES ON THE WEB AND SEMI-STRUCTURED DATA

Web interface, XML, structure of XML data, querying XML data, XML applications, semi-structured data model, indexes for text data.

UNIT V ENHANCED DATA MODELS FOR ADVANCED APPLICATIONS

Active database concepts, temporal database concepts, spatial databases: concept and architecture, deductive databases and query processing, mobile databases, Geographic Information Systems (GIS).

Text Book:

1. Ramez Elmasri and Shamkant B. Navathe, *"Fundamentals of Database Systems"*, Pearson Education, 7th Edition, 2017.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, *"Database System Concepts"*, McGraw-Hill Education, 7th Edition, 2019.

2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V.S. Subrahmanian and Roberto Zicari, *"Advanced Database Systems"*, Morgan Kaufmann Publishers, 1st Edition, 1997.
3. Raghu Ramakrishnan and Johannes Gehrke, *"Database Management Systems"*, McGraw-Hill Education, 3rd Edition, 2003.
4. C.J. Date, *"An Introduction to Database Systems"*, Pearson Education, 8th Edition, 2004.
5. Thomas Connolly and Carolyn Begg, *"Database Systems: A Practical Approach to Design, Implementation and Management"*, Pearson Education, 6th Edition, 2014.

E-resources:

1. <https://www.geeksforgeeks.org/dbms/>
2. <https://www.javatpoint.com/dbms-tutorial>
3. <https://www.tutorialspoint.com/dbms/index.htm>
4. <https://www.w3schools.com/sql/>
5. <https://www.postgresql.org/docs/>
6. <https://dev.mysql.com/doc/>

Core - Theory V
FULL STACK DEVELOPMENT
COURSE CODE : 24PCS105

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

SYLLABUS:

UNIT – I : INTRODUCTION WEB DEVELOPMENT:

Web Development Basics: Web development Basics - HTML & Web servers Shell - UNIX CLI
Version control - Git & Github HTML, CSS

UNIT – II: FRONT END DEVELOPMENT:

Frontend Development: JavaScript basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format.

UNIT – III: REACT JS:

REACT JS: Introduction to React React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication.

UNIT – IV :JAVA WEB DEVELOPMENT:

JavaWeb Development: JAVA PROGRAMMING BASICS ,Model View Controller (MVC) Pattern MVC Architecture using Spring RESTful API using Spring Framework Building an application using Maven

UNIT – V :DATABASE AND DEPLOYMENT:

Databases & Deployment: Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles and deploying application in Cloud

Text Book:

1. Randy Connolly and Ricardo Hoar, *"Fundamentals of Web Development"*, Pearson Education, 3rd Edition, 2021.

Reference Books:

1. Jon Duckett, *"HTML and CSS: Design and Build Websites"*, Wiley, 1st Edition, 2011.
2. Jon Duckett, *"JavaScript and JQuery: Interactive Front-End Web Development"*, Wiley, 1st Edition, 2014.
3. Vasam Subramanian, *"Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node"*, Apress, 2nd Edition, 2019.
4. Craig Walls, *"Spring in Action"*, Manning Publications, 6th Edition, 2022.
5. Bryan Basham, Kathy Sierra and Bert Bates, *"Head First Servlets and JSP"*, O'Reilly Media, 2nd Edition, 2008.

E-resources:

1. <https://developer.mozilla.org/en-US/>
2. <https://git-scm.com/doc>
3. <https://docs.github.com/>
4. <https://react.dev/>
5. <https://redux.js.org/>
6. <https://spring.io/projects/spring-framework>
7. <https://spring.io/guides>
8. <https://www.w3schools.com/sql/>
9. <https://maven.apache.org/guides/>
10. <https://www.geeksforgeeks.org/web-development/>

Core Laboratory – III1 ADVANCED DATABASE USING NOSQL LAB
COURSE CODE : 24PCS303

Credits: 2

Contact Hours/Week: 4

Internal marks : 40

External marks: 60

SYLLABUS

Implement the following Concepts:

1. Tables Creations, Sorting, Setting relation between tables
2. Queries using single and multiple tables
3. Exception Handling
4. Cursor and Triggers
5. Import & Export Tables
6. Indexing and Query Processing
7. Reports

Core Laboratory – IV FULL STACK DEVELOPMENT LAB
COURSE CODE : 24PCS304

Credits: 2

Contact Hours/Week: 4

Internal marks : 40

External marks: 60

Syllabus

1. Write a program to create a simple webpage using HTML.
2. Write a program to create a website using HTML CSS and JavaScript?
3. Write a program to build a Chat module using HTML CSS and JavaScript?
4. Write a program to create a simple calculator Application using React JS
5. Write a program to create a voting application using React JS
6. Write a program to create and Build a Password Strength Check using JQuery.
7. Write a program to create and Build a star rating system using JQuery.
8. Create a Simple Login form using React JS
9. Create a blog using React JS Using the CMS users must be able to design a web page using the drag and drop method. Users should be able to add textual or media content into placeholders that are attached to locations on the web page using drag and drop method.
10. Create a project on Grocery delivery application Assume this project is for a huge online departmental store. Assume that they have a myriad of grocery items at their godown. All items must be listed on the website, along with their quantities and prices. Users must be able to sign up and purchase groceries. The system should present him with delivery slot options, and the user must be able to choose his preferred slot. Users must then be taken to the payment page where he makes the payment with his favourite method.
11. Connecting our TODO React js Project with Firebase

CORE COURSE - VI

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING - 24PCS106

Hours/Week: 5

Credits: 4

Internal marks : 25

External marks: 75

SYLLABUS:

UNIT – I : INTRODUCTION TO MACHINE LEARNING:

Introduction ,Components of Learning , Learning Models , Geometric Models, Probabilistic Models, Logic Models, Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised, Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension.

UNIT – II SUPERVISED AND UNSUPERVISED LEARNING:

Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perception, Multilayer Perception, Support Vector Machines: Linear and Non-Linear, Kernel Functions, K Nearest Neighbors. Introduction to clustering, K-means clustering, K-Mode Clustering.

UNIT – III ENSEMBLE AND PROBABILISTIC LEARNING:

Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging:Random Forest Trees, Boosting: Adaboost, Stacking. Gaussian mixture models - The Expectation-Maximization (EM) Algorithm, Information Criteria, Nearest neighbour methods - Nearest Neighbour Smoothing, Efficient Distance Computations: the KD-Tree, Distance Measures.

UNIT – IV REINFORCEMENT LEARNING AND EVALUATING HYPOTHESES:

Introduction, Learning Task, Q Learning, Non deterministic Rewards and actions, temporal-difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in reinforcement learning. Motivation, Basics of Sampling Theory: Error Estimation and Estimating Binomial Proportions, The Binomial Distribution, Estimators, Bias, and Variance

UNIT – V INTRODUCTION OF AI:

Definition of AI- AI Problems – Underlying Assumption – AI technique – Level of the Model - Criteria for Success. Problems, Problem Spaces, Search: Defining the Problem as State Space Search - Production Systems - problem Characteristics – Production System Characteristics

Text Book:

1. Ethem Alpaydin, *"Introduction to Machine Learning"*, MIT Press, 4th Edition, 2020.

Reference Books:

1. Tom M. Mitchell, *"Machine Learning"*, McGraw-Hill Education, 1st Edition, 1997.
2. Christopher M. Bishop, *"Pattern Recognition and Machine Learning"*, Springer, 1st Edition, 2006.
3. Stephen Marsland, *"Machine Learning: An Algorithmic Perspective"*, CRC Press, 2nd Edition, 2014.
4. Stuart Russell and Peter Norvig, *"Artificial Intelligence: A Modern Approach"*, Pearson Education, 4th Edition, 2021.
5. Kevin P. Murphy, *"Machine Learning: A Probabilistic Perspective"*, MIT Press, 1st Edition, 2012.

E-resources:

1. <https://www.geeksforgeeks.org/machine-learning/>
2. https://www.tutorialspoint.com/machine_learning/index.htm
3. <https://developers.google.com/machine-learning>
4. <https://scikit-learn.org/stable/>

CORE COURSE - V

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB: 24PCS305

Credits: 2

Internal marks : 40

Contact Hours/Week: 4

External marks: 60

SYLLABUS:

1. Cleaning and Pre-processing Data: Handles missing values, encodes categorical variables, and scales features.
2. Feature Extraction: PCA to reduce dimensionality
3. Simple Linear Regression: Simple linear regression model on a dataset. a. Sum
4. K Nearest Neighbors: KNN classifier on the Iris dataset.
5. K-means Clustering: K-means clustering to segment data into cluster
6. Classification (Logistic Regression): Logistic regression for binary classification on the breast cancer dataset..
7. Support Vector Machines (SVM): SVM classifier for the Iris dataset, with a visual decision boundary.

Tools Required

- Notepad Editor
- Any Browser
- E-Resources

ELECTIVE THEORY - III

CLOUD PLATFORM IN DEVOPS-24PCS205

Hours/Week: 5

Internal marks : 25

Credits: 4

External marks: 75

SYLLABUS:

UNIT – I Cloud Computing Introduction:

Cloud Computing, Why Cloud Computing, Advantages of Cloud Computing, Virtualization, cloud servicemodels, Cloud deployment models, public clouds: Amazon Web Services, Microsoft Azure, and Google Cloud Services.

AWS Cloud services: IAM Roles, and Policies, EC2, S3, VPC, RDS

UNIT – II DevOps Introduction

DevOps definition, History of DevOps, DevOps Roles, DevOps Need, DevOps Problems & Solution, DevOps Main Objectives, DevOps: Continuous Delivery and Benefits, DevOps and Software Development Life Cycle: Waterfall Model, Agile Model, DevOps on Cloud.

UNIT – III Compile, Build & Continuous Integration

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test,package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle continuous integration/continuous delivery using Jenkins,Definition of Jenkins, Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job,

Configuring a Jenkins job, Introduction to Plugins, Commonly used plugins (Git Plugin,). Jenkins Build Pipe Line.

UNIT – IV Configuration management and containerization

Containerization: Docker, What is Docker Image, Docker Installation, Working with Docker Containers,Container, Docker Engine, Crating Containers with an Image, Working with Images, Docker Command Line Interface, Docker Compose, Docker Hub, Docker Trusted Registry, Docker swarm, Docker attach,Docker File & Commands.

Configuration: Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics,Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles.

UNIT – V BUILDING DEVOPS PIPELINES USING AWS

Create Github Account, Repository, Create AWS Organization, Create a new pipeline, Build a samplecode, Modify AWS-pipelines.

Text Book:

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, "*Mastering Cloud Computing: Foundations and Applications Programming*", McGraw-Hill Education, 1st Edition, 2013.

Reference Books:

1. Thomas Erl, Ricardo Puttini and Zaigham Mahmood, "*Cloud Computing: Concepts, Technology & Architecture*", Pearson Education, 1st Edition, 2013.

2. Gene Kim, Jez Humble, Patrick Debois and John Willis, *"The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations"*, IT Revolution Press, 2nd Edition, 2021.
3. Kief Morris, *"Infrastructure as Code: Managing Servers in the Cloud"*, O'Reilly Media, 2nd Edition, 2020.
4. Nigel Poulton, *"The Docker Deep Dive"*, Independently Published, 2023 Edition.
5. Jeff Geerling, *"Ansible for DevOps"*, Leanpub, 4th Edition, 2023.

E-resources:

1. <https://aws.amazon.com/getting-started/>
2. <https://docs.aws.amazon.com/>
3. <https://azure.microsoft.com/en-in/resources/cloud-computing-dictionary/>
4. <https://cloud.google.com/docs>

SEMESTER III
Core Course VII
24PCS107: Open Source Application Development

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus:

Unit-I:

Introduction to Open Source Software: Overview of Open Source Software: Definition and history of open source software-Difference between open-source and proprietary software -Key benefits of open-source software-Major open-source projects and their impact -Open Source Licenses and Legal Aspects: Overview of open-source licenses Open Source Community and Governance: Structure of open-source communities-Roles in open source development: contributors, maintainers, and users-Governance models for open-source projects-Popular open-source community platforms - Intellectual Property Rights.

Unit-II:

Tools and Workflow for Open Source Development Version Control with Git -Introduction to version control systems -Git fundamentals -Git workflow in open-source development -Using GitHub/GitLab for collaboration -Open Source Development Tools: Integrated Development Environments (IDEs) for open-source development -Using bug trackers and issue management systems .

Unit-III:

Open Source Development Methodologies Agile Methodologies in Open Source: Understanding Agile principles -Scrum, Kanban, and Lean in open-source projects -Working with sprints and backlogs in open-source development -Time management and prioritization in distributed teams -Bug Tracking, Issue Reporting, and Project Management: How to report and handle bugs in open-source projects.

Unit-IV:

Developing Open Source Applications Designing Open Source Applications: Best practices for application architecture in open-source projects -Modular design and reusable code -Creating accessible and well-documented APIs-Managing dependencies and libraries - Open Source Technologies and Frameworks -Introduction to common open source frameworks - Using open-source databases - Leveraging open-source tools for development .

Unit-V:

Contributing to and Maintaining Open Source Projects Contributing to Open Source Projects: Finding open-source projects to contribute to (e.g., using GitHub Explore, GitLab) -Etiquette and practices for first-time contributors -Building your open-source portfolio and reputation -Managing an Open Source Project :How to create and maintain a thriving open source project -Building a contributor community - Managing contributors, pull requests, and releases Handling project funding and sustainability (e.g., using Patreon, Open Collective).

Text Book:

1. Karl Fogel, *"Producing Open Source Software: How to Run a Successful Free Software Project"*, O'Reilly Media, 2nd Edition, 2023.

Reference Books:

1. Vicky Brasseur, *"Forge Your Future with Open Source: Build Your Skills and Career Through Open Source Contributions"*, Pragmatic Bookshelf, 1st Edition, 2018.
2. Karl Fogel, *"Producing Open Source Software: How to Run a Successful Free Software Project"*, O'Reilly Media, 2nd Edition, 2017.
3. Eric S. Raymond, *"The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary"*, O'Reilly Media, Revised Edition, 2001.
4. Ben Cotton, *"Program Management for Open Source Projects"*, Pragmatic Bookshelf, 1st Edition, 2021.
5. VM (Vicky) Brasseur, *"Open Source for Business: A Practical Guide to Open Source Software Licensing, Project Management, and Community Building"*, Pragmatic Bookshelf, 1st Edition, 2023.

E-resources:

1. <https://producingoss.com/>
2. <https://opensource.guide/>
3. <https://opensource.org/licenses>
4. <https://docs.github.com/>

Core Course - VIII
24PCS108 - Cyber Security and Ethical Hacking

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus:

Unit I: Introduction to Information Security & Need for Security

Definition of Information Security - Importance of Information Security in the modern world- Types of Security (Physical Network, and Cybersecurity) -Threats and Vulnerabilities in Information Systems - The Role of Cyber Security Professionals -Introduction to basic security measures and frameworks

Unit II: Security Technologies & Cryptography

Overview of Security Technologies - Firewalls, Intrusion Detection Systems, and Intrusion Prevention Systems - Encryption and Decryption techniques -Symmetric vs. Asymmetric Cryptography - Public Key Infrastructure (PKI) -Cryptographic protocols (SSL/TLS, IPsec)

Unit III: Risk Management

Fundamentals of Risk Management in Cyber Security -Risk Assessment Frameworks (e.g., NIST, ISO 27001) -Identifying and assessing risks -Risk mitigation strategies -Business Continuity Planning and Disaster Recovery-Case studies of risk management failures and successes.

Unit IV: Ethical Hacking Overview

Introduction to Ethical Hacking and its ethical implications -Reconnaissance techniques and Tools - Penetration Testing Lifecycle -Common Hacking Techniques: Social Engineering, Phishing, etc.-Legal and Ethical Issues in Hacking-Vulnerability Scanning Tools and Techniques.

Unit V: Enumeration and Vulnerability Analysis

Enumeration Techniques and Tools -Scanning for network and system vulnerabilities identifying open ports, services, and weak passwords -Exploiting vulnerabilities in networks and systems - Creating vulnerability reports and remediation strategies -Security Auditing

Text Book:

1. Michael E. Whitman and Herbert J. Mattord, *"Principles of Information Security"*, Cengage Learning, 7th Edition, 2021.

Reference Books:

1. William Stallings and Lawrie Brown, *"Computer Security: Principles and Practice"*, Pearson Education, 5th Edition, 2023.
2. Nina Godbole and Sunit Belapure, *"Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives"*, Wiley India, 1st Edition, 2011.
3. Charles P. Pfleeger and Shari Lawrence Pfleeger, *"Security in Computing"*, Pearson Education, 5th Edition, 2015.
4. Georgia Weidman, *"Penetration Testing: A Hands-On Introduction to Hacking"*, No Starch Press, 1st Edition, 2014.

5. Kevin Beaver, *"Hacking For Dummies"*, Wiley, 7th Edition, 2022.

E-resources:

1. <https://www.cisa.gov/cybersecurity>
2. <https://www.nist.gov/cyberframework>
3. <https://owasp.org/>
4. <https://www.sans.org/security-resources/>
5. <https://www.geeksforgeeks.org/cyber-security-tutorial/>
6. <https://www.tutorialspoint.com/cryptography/index.htm>

Core Course IX
24PCS109: Deep Learning

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus:

Unit I

Introduction to Neural Networks – Introduction – Basic Architecture of Neural Networks – Training and Neural Network with Backpropagation – Practical Issues in Neural Network Training – The Secrets to the Power of Function Composition – Common Neural Architectures – Advanced Topics.

Unit II

Machine Learning with Shallow Neural Networks: Introduction – Neural Architectures for Binary Classification Models – Neural Architectures for Multiclass models – Back propagated saliency for Feature Selection – Matrix Factorization with Auto encoders – Simple Neural Architectures for Graph Embedding.

Unit III

Training Deep Neural Networks: Introduction – Back propagation – Setup and Initialization issues – The vanishing and exploding gradient problems – Gradient Descent Strategies – Batch Normalization – Teaching Deep Learners to Generalize: Introduction The Bias-Variance trade-off – Generalization issues in model tuning and evaluation – Penalty based regularization – Ensemble methods – Early Stopping – Unsupervised pre training – Continuation and Curriculum learning – Parameter sharing – Regularization in Unsupervised Applications.

Unit IV

Recurrent Neural Networks: Introduction – Architecture of Recurrent Neural Networks The challenges of training recurrent networks – Echo-State Networks – Long Short-Term memory – Gated Recurrent Units – Applications of Recurrent Neural Networks. Convolutional Neural Networks: Introduction – The Basic Structure of a Convolutional Network – Training a convolutional network – Case studies of Convolutional Architectures – Visualization and Unsupervised Learning – Applications of Convolutional networks.

Unit V

Deep Reinforcement Learning: Introduction – Stateless Algorithms – The basic framework of Reinforcement Learning – Bootstrapping for value function learning – Policy Gradient Methods – Monte Carlo Tree Search – Case Studies – Practical Challenges associated with safety. Advanced Topics associated with Deep Learning: Generative Adversarial Networks (GAN) – Competitive Learning – Limitations of Neural Networks.

Text Book:

1. Charu C. Aggarwal, *"Neural Networks and Deep Learning: A Textbook"*, Springer, 2nd Edition, 2023.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, *"Deep Learning"*, MIT Press, 1st Edition, 2016.
2. François Chollet, *"Deep Learning with Python"*, Manning Publications, 2nd Edition, 2021.
3. Michael Nielsen, *"Neural Networks and Deep Learning"*, Determination Press, 1st Edition, 2015.
4. Simon Haykin, *"Neural Networks and Learning Machines"*, Pearson Education, 3rd Edition, 2009.
5. Aurélien Géron, *"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"*, O'Reilly Media, 3rd Edition, 2022.

E-resources:

1. <https://www.geeksforgeeks.org/introduction-deep-learning/>
2. <https://www.tpointtech.com/deep-learning>
3. https://www.tutorialspoint.com/machine_learning/deep_machine_learning.html
4. <https://www.deeplearningbook.org/>

Core laboratory – VI
24PCS306: Deep Learning Lab

Credits: 2
Contact Hours/Week: 4

Internal marks : 40
External marks: 60

Syllabus:

1. Implement a Single-Layer Perceptron to solve logical operations like AND and OR.
2. Train a Feed forward Neural Network with Back propagation on the Iris dataset for binary classification.
3. Build and Evaluate a Multiclass Neural Network using soft max activation for the MNIST dataset.
4. Visualize Feature Importance using back propagated saliency maps on image data.
5. Implement an Auto encoder for Dimensionality Reduction on Fashion MNIST.
6. Demonstrate the Vanishing Gradient Problem using a deep sigmoid network and visualize gradients
7. Apply Batch Normalization and Dropout to improve model performance on CIFAR
8. Build a Sentiment Analysis Model using LSTM on the IMDB dataset.
9. Train a CNN for Image Classification and visualize feature maps using a convolutional architecture.
10. Implement a Basic GAN to generate handwritten digits similar to MNIST.
11. Solving XOR problem using Multilayer perceptron
12. Implement character and Digit Recognition using ANN.
13. Develop a code to design object detection and classification for traffic analysis using CNN.
14. Implement the analysis of X-ray image using auto encoders

Elective Course IV
24PCS203: Object Oriented Analysis and Design

Hours/Week: 5

Credits: 4

Internal marks : 25

External marks: 75

Syllabus:

Unit – I:

INTRODUCTION TO UML: Introduction to object oriented concepts like inheritance, Polymorphism, Information hiding, Importance of modelling, Principles of modelling, Object oriented modelling, An overview of UML, Conceptual model of the UML, Architecture, Software development life cycle. Basic structural modeling: Classes: Terms and concepts, Common Modelling techniques; Relationships Modelling simple dependencies, Single inheritance and structural relationships; Common mechanisms and diagrams. Advanced Structural Modeling: Advance classes, Advance relationships, Interfaces, Types and Roles, Packages, Instances.

Unit – II:

THE OBJECT-ORIENTED DESIGN PROCESS: The object and class Concepts, Identifying classes, Identifying responsibilities, Relationships between Classes, Use Cases, CRC cards, UML class diagrams, Sequence diagrams, State diagrams, Using Java doc for design documentation, Case Study: A voice mail system.

Unit – III:

GUIDELINES FOR CLASS DESIGN: An overview of the date classes in the java library, designing a day class, the importance of encapsulation, analysing the quality of an interface, programming by contract, unit testing. Interface types and Polymorphism: The icon interface type, polymorphism, drawing shapes, the comparable interface type, the comparator interface type, anonymous classes, frames and user interface components, user interface actions, timers, designing an interface type.

Unit – IV:

PATTERNS AND GUI PROGRAMMING: Iterators, the pattern concept, the observer pattern, layout managers and the strategy pattern, components, containers and the composite pattern, scroll bars and the decorator pattern, how to recognize patterns, putting patterns to work. Inheritance and abstract classes: The concept of inheritance, graphics programming with inheritance, abstract classes, the template method pattern, protected interfaces, the hierarchy of swing components, the hierarchy of standard geometric shapes, the hierarchy of exception classes, when not to use inheritance.

Unit – V:

FRAMEWORKS: Frameworks, applets as a simple framework, the collections framework, a graph editor framework, enhancing the graph editor framework. Multithreading: Thread basics, Thread synchronization, Animations. More design patterns: The Adapter pattern, Actions and the command pattern, the factory method pattern, the proxy pattern, the singleton pattern, the visitor pattern, other design patterns.

Text Book:

1. Grady Booch, James Rumbaugh and Ivar Jacobson, *"The Unified Modeling Language User*

Guide", Addison-Wesley Professional, 2nd Edition, 2005.

Reference Books:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Pearson Education, 3rd Edition, 2004.
2. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Addison-Wesley Professional, 3rd Edition, 2003.
3. Cay S. Horstmann, "*Object-Oriented Design and Patterns*", Wiley, 2nd Edition, 2005.
4. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, "*Design Patterns: Elements of Reusable Object-Oriented Software*", Addison-Wesley Professional, 1st Edition, 1994.
5. Bernd Bruegge and Allen H. Dutoit, "*Object-Oriented Software Engineering: Using UML, Patterns, and Java*", Pearson Education, 3rd Edition, 2009.

E-resources:

1. <https://www.uml.org/>
2. <https://www.geeksforgeeks.org/unified-modeling-language-uml-introduction/>
3. <https://www.tutorialspoint.com/uml/index.htm>
4. <https://plantuml.com/>
5. <https://sparxsystems.com/resources/tutorials/uml2/>
6. <https://refactoring.guru/design-patterns>
7. <https://www.oracle.com/java/technologies/javase/codeconventions-introduction.html>

Elective Course IV
24PCS206: Docker for DevOps

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus

Unit - I:

Overview of Containerization and Virtualization- Introduction to Docker and its Benefits- Installing and Configuring Docker (Windows, Linux, Mac)- Understanding Docker CLI and Basic Commands-Working with Docker Images and Containers- Running, Stopping, and Removing Containers- Docker Hub: Pulling and Pushing Images.

Unit - II:

Understanding Docker Engine, Daemon, and CLI- Exploring Dockerfile and Image Creation- Docker Storage: Volumes, Bind Mounts, and tmpfs- Managing Multi-Container Applications- Environment Variables and Configuration Management- Understanding Docker Registries (Public and Private).

Unit - III:

Overview of Docker Networking- Types of Networks: Bridge, Host, Overlay, and Macvlan- Connecting Multiple Containers Using Docker Networks- Data Persistence with Docker Volumes- Storage Drivers: AUFS, OverlayFS, Btrfs, and ZFS- Debugging and Monitoring Docker Networking.

Unit - IV:

Overview of Docker Networking- Types of Networks: Bridge, Host, Overlay, and Macvlan- Connecting Multiple Containers Using Docker Networks- Data Persistence with Docker Volumes- Storage Drivers: AUFS, OverlayFS, Btrfs, and ZFS- Debugging and Monitoring Docker Networking.

Unit - V:

Understanding CI/CD Pipeline in DevOps- Integrating Docker with Jenkins, GitHub Actions, and GitLab CI- Automating Image Builds and Deployments- Best Practices for Security, Performance, and Scaling-Monitoring Docker Applications with Prometheus and Grafana- Deploying Dockerized Applications on AWS, Azure, and GCP.

Text Book:

1. Nigel Poulton, *"Docker Deep Dive: Zero to Docker in a Single Book"*, Independently Published, 2023 Edition.

Reference Books:

1. Karl Matthias and Sean P. Kane, *"Docker: Up & Running"*, O'Reilly Media, 3rd Edition, 2023.
2. Elton Stoneman, *"Learn Docker in a Month of Lunches"*, Manning Publications, 2nd Edition, 2022.
3. Adrian Mouat, *"Using Docker: Developing and Deploying Software with Containers"*, O'Reilly Media, 2nd Edition, 2023.
4. Jeff Nickoloff and Stephen Kuenzli, *"Docker in Action"*, Manning Publications, 2nd Edition, 2019.

5. James Turnbull, *"The Docker Book: Containerization is the New Virtualization"*, James Turnbull Publishing, 2018.

E-resources:

1. <https://docs.docker.com/>
2. <https://www.docker.com/resources/>
3. <https://hub.docker.com/>
4. <https://www.geeksforgeeks.org/docker-tutorial/>
5. <https://www.tutorialspoint.com/docker/index.htm>
6. <https://www.jenkins.io/doc/>
7. <https://docs.github.com/en/actions>
8. <https://docs.gitlab.com/ee/c>

Elective Course -IV
24PCS209 - Data-Driven Wireless Sensor Networks

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus:

Unit -I: Introduction to Wireless Sensor Networks (WSNs):

Overview of Wireless Sensor Networks-Definition and applications of WSNs-Components: Sensors, Actuators, Network protocols-Challenges in WSNs -Basic Concepts of Sensors-Types of sensors -Sensor performance metrics -Communication in WSNs-Wireless communication standards-Low-power wireless communication protocols-Communication models.

Unit- II: Data Collection and Processing in WSNs

Data Collection Methods- Acquisition and sampling techniques -Data aggregation and sensor fusion methods-Data Communication Protocols -MAC protocols: CSMA, TDMA, FDMA - Routing protocols: Flat, Hierarchical, and Location-based Routing-Data-centric routing protocols - Data Storage and Handling -Distributed vs centralized data processing models- Collaborative data processing techniques in WSNs.

Unit-III: Energy Efficiency in WSNs:

Energy Constraints and Challenges in WSNs-Power consumption models of sensor nodes - Energy-saving strategies for WSNs Energy-Efficient Protocols -Energy efficient MAC protocols - Routing protocols for energy optimization- Sleep/wake scheduling and adaptive energy management- Power Management -Low-power hardware design principles -Energy harvesting techniques for WSNs- Optimizing energy consumption in data transmission

Unit -IV: Data-Driven Algorithms and Machine Learning in WSNs

Data-Driven Decision Making - Real-time data analysis and event detection techniques Temporal and spatial analysis in sensor networks - Machine Learning Techniques in WSNs Supervised and unsupervised learning for sensor data analysis – Clustering -K-means, hierarchical clustering and classification algorithms –SVM -decision trees Anomaly detection, pattern recognition, and predictive models -Data Mining and Big Data Integration.

Unit V: Security and Privacy in WSNs

Security Challenges in WSNs - Threats to sensor networks - Cryptographic methods for secure communication in WSNs -Privacy Concerns in Data Collection - Privacy-preserving techniques for sensor data aggregation -Differential privacy mechanisms for WSNs -Secure Routing and Communication -Secure routing protocols -SEAD, ARAN -Securing data aggregation and storage in WSNs -Countermeasures for attacks in WSNs

Text Book:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, *"Wireless Sensor Networks: Technology, Protocols, and Applications"*, Wiley, 1st Edition, 2007.

Reference Books:

1. Holger Karl and Andreas Willig, *"Protocols and Architectures for Wireless Sensor Networks"*, Wiley, 1st Edition, 2005.
2. Waltenegus Dargie and Christian Poellabauer, *"Fundamentals of Wireless Sensor Networks: Theory and Practice"*, Wiley, 2nd Edition, 2022.
3. C. S. Raghavendra, Krishna M. Sivalingam and Taieb Znati, *"Wireless Sensor Networks"*, Springer, 1st Edition, 2006.
4. Mohammad Ilyas and Imad Mahgoub, *"Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems"*, CRC Press, 1st Edition, 2018.
5. Feng Zhao and Leonidas Guibas, *"Wireless Sensor Networks: An Information Processing Approach"*, Morgan Kaufmann, 1st Edition, 2004.

E-resources:

1. <https://nptel.ac.in/courses/106105160>
2. <https://www.sciencedirect.com/topics/computer-science/wireless-sensor-network>
3. <https://www.mdpi.com/journal/sensors>

Elective course IV

24PCS212: Firebase for Android Development

Hours/Week: 5

Credits: 4

Internal marks : 25

External marks: 75

Syllabus:

Unit- I: Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, building you First Android application, Understanding Anatomy of Android Application, Android Manifest file

Unit - II: Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions

Unit- III: Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation

Unit - IV: Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

Unit- V: Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Text Book:

1. Wei-Meng Lee, "Beginning Android Application Development", Wiley, 5th Edition, 2018.

Reference Books:

1. Reto Meier and Ian Lake, "*Professional Android*", Wiley, 4th Edition, 2018.

2. Bill Phillips, Chris Stewart, Kristin Marsicano and Brian Hardy, "*Android Programming: The Big Nerd Ranch Guide*", Big Nerd Ranch Guides, 5th Edition, 2019.

3. Jerome DiMarzio, "*Android Programming with Android Studio for Beginners*", Packt Publishing, 2nd Edition, 2020.

4. Dawn Griffiths and David Griffiths, "*Head First Android Development*", O'Reilly Media, 3rd Edition, 2021.

5. John Horton, "*Android Programming for Beginners*", Packt Publishing, 3rd Edition, 2021.

E-resources:

1. <https://developer.android.com/>

2. <https://developer.android.com/guide>

3. <https://developer.android.com/training>

4. <https://developer.android.com/studio>
5. <https://source.android.com/>
6. <https://www.geeksforgeeks.org/android-tutorial/>
7. <https://www.javatpoint.com/android-tutorial>
8. <https://www.tutorialspoint.com/android/index.htm>
9. <https://kotlinlang.org/docs/android-overview.html>
10. <https://developer.android.com/courses>
11. <https://developer.android.com/topic/libraries/architecture>
12. <https://sqlite.org/docs.html>

SEMESTER IV

Elective course V

24PCS214: Reinforcement learning

Hours/Week: 5

Internal marks : 25

Credits: 4

External marks: 75

Syllabus

UNIT I

Understand the basics of reinforcement learning: Reinforcement Learning - A Preamble - Reinforcement Learning Frameworks: Problems and Solutions –An extended example: Tic Tac Toe-Limitations and scope.

UNIT II

Apply deep learning architectures to solve the problem: Build and Train Neural Networks, Convolutional Neural Networks - Bandit Algorithms -Deep Q-Learning – Deep-Network - Double Deep Q-Network-Dueling-DAN CaseStudy: Leveraging Neural Networks to predict machine failures that learns intelligent behaviors from sensory data.

UNIT III

Analyze reinforcement Learning algorithms in uncertain conditions: Evolutionary Algorithms, Stochastic Policy Search, Reinforcement Algorithms - Improving Policy Gradient Methods - Generalized Advantage Estimation - Policy Optimization method: Trust Region Policy Optimization (TRPO) - Case Study: Deep Reinforcement Learning for Robotics (Robotic arm/ four-legged creature walk).

UNIT IV

Apply Dynamic Programming for Markov Decision Process: Dynamic Programming (DP): Overview of dynamic programming for MDP, principle of optimality, Policy Evaluation, Policy Improvement, policy iteration, value iteration, Generalized Policy Iteration. Monte Carlo Methods for Prediction and Control.

UNIT V

Analyze Temporal Difference Methods: Temporal Difference Methods- TD Prediction, Optimality of TD (0), TD Control methods -SARSA, Q Learning and their variants.

Text Book:

1. Richard S. Sutton and Andrew G. Barto, *"Reinforcement Learning: An Introduction"*, MIT Press, 2nd Edition, 2018.

Reference Books:

1. Phil Winder, *"Reinforcement Learning: Industrial Applications of Intelligent Agents"*, O'Reilly Media, 1st Edition, 2020.

2. Maxim Lapan, *"Deep Reinforcement Learning Hands-On"*, Packt Publishing, 3rd Edition, 2024.
3. Laura Graesser and Wah Loon Keng, *"Foundations of Deep Reinforcement Learning"*, Addison-Wesley Professional, 2nd Edition, 2024.
4. Csaba Szepesvári, *"Algorithms for Reinforcement Learning"*, Morgan & Claypool Publishers, 2nd Edition, 2019.
5. Marco Wiering and Martijn van Otterlo, *"Reinforcement Learning: State-of-the-Art"*, Springer, 1st Edition, 2012.

E-resources:

1. <https://www.davidsilver.uk/teaching/>
2. <https://spinningup.openai.com/>
3. <https://www.tensorflow.org/agents>
4. <https://gymnasium.farama.org/>
5. <https://stable-baselines3.readthedocs.io/>
6. <https://www.coursera.org/specializations/reinforcement-learning>

Elective Course VI
4PCS217: 5G and Network Technologies

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus:

UNIT I: Introduction to 5G Networks Evolution of Mobile Networks from 1G to 5G- Key Features of 5G- 5G Use Cases and Applications-Global Standards and Regulatory Aspects- 3GPP, ITU, and Spectrum Allocation.

UNIT II: 5G Network Architecture

5G System Architecture- Core Network and RAN- NFV and SDN- Concepts and Applications in 5G- Network Slicing- Edge Computing- Bringing Computation Closer to the User.

UNIT III: 5G Radio Technologies

Millimeter-Wave Communications- Massive- MIMO- Enhancing Capacity and Coverage- Beamforming Techniques- Directing Signals Towards Users- Waveforms and Modulation Schemes- OFDM and Its Variants.

UNIT IV: 5G Network Deployment and Management

Deployment Strategies: Standalone vs. Non-Standalone Architectures- Interference Management: Techniques to Mitigate Signal Interference- Mobility and Handoff Management- Ensuring Seamless Connectivity- Dynamic Spectrum Sharing- Efficient Utilization of Available Spectrum.

UNIT V: Security and Future Trends in 5G

Security Challenges in 5G Networks- Threats and Vulnerabilities-Authentication and Encryption Mechanisms- Protecting Data and Privacy- Introduction to Beyond 5G (B5G) and 6G- Emerging Technologies and Research Directions- Standardization Efforts and Industry Initiatives- Role of Organizations in Shaping Future Networks

Text book:

1. Erik Dahlman, Stefan Parkvall, Johan Skold, —5G-Advanced: The New Generation Wireless Access Technology, Academic Press, 3rd Edition, 2023;
2. Indrasen Singh, Shubham Tayal, Niraj Pratap Singh, Vijay Shanker Tripathi, Ghanshyam Singh, — 5G and Beyond Wireless Networks: Technology, Network Deployments, and Materials for Antenna Design, CRC Press, 1st Edition, 2024;

Reference Book:

1. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, —5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016.
2. Jonathan Rodriguez, —Fundamentals of 5G Mobile Networks, Wiley, 2015.
3. Sundee Rangan, Theodore S. Rappaport, —Millimeter Wave Wireless Communications, Pearson, 2014.
4. Martin Sauter, —From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband, Wiley, 2017.
5. Amitabha Ghosh, Rapeepat Ratasuk, —Essentials of 5G Networking and Security, Wiley, 2021.

Reference Links:

1. <https://www.3gpp.org>
2. <https://www.itu.int>
3. <https://www.gsma.com/futurenetworks/>
4. <https://5g-ppp.eu/>
5. <https://www.qualcomm.com/research/5g>
6. <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-187.pdf>

Elective Course V
24PCS220 -Responsive and Adaptive Design

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus

Unit-I : Introduction to Responsive and Adaptive Design:

Overview of Web Design Evolution: Static, fluid, responsive, and adaptive design approaches. -How the increasing variety of devices changed web design. Responsive Design vs. Adaptive Design: Key differences, advantages, and use cases. - When to choose responsive over adaptive, and vice versa. Principles of Responsive Web Design: Mobile-first design philosophy. - Fluid grids, flexible images, and scalable vector graphics (SVG).

Unit -II: Fluid Grids and Flexible Layouts:

Understanding Fluid Grids: Introduction to grid-based design. -How to create flexible layouts using percentages instead of fixed pixel sizes-CSS Flexbox: Overview of flexbox and its advantages in creating flexible, responsive layouts-Practical examples and exercises-CSS Grid: Basics of CSS Grid Layout for more complex responsive designs -Grid areas, spans, and how to align content responsively.

Unit -III: Media Queries and Breakpoints

Media Queries -Setting Breakpoints: Identifying common breakpoints for smartphones, tablets, and desktop displays - Strategies for designing breakpoints based on content instead of screen size-Best Practices for Responsive Typography: Using relative units (em, rem) to create scalable typography-Tools for setting up fluid typography.

Unit IV: Mobile-First Design:

Overview of mobile-first design principles-Why mobile-first is critical for responsive design-Building Mobile-First Layouts:How to design and develop for mobile first, then scale up for larger screens-Utilizing media queries to adjust layouts for larger screens like tablet, desktop-Responsive Navigation:Designing mobile-friendly navigation systems -hamburger menus, collapsible menus.

Unit -V: Adaptive Design Strategies

Introduction to Adaptive Design:Creating Adaptive Layouts:Tools for Adaptive Design: Introduction to libraries and tools that assist in adaptive web design- Bootstrap, Foundation, and Modernizr .Responsive Design Frameworks:CSS Frameworks: Introduction to popular frameworks-.Benefits and drawbacks of using frameworks for responsive design-Responsive Images and Media: Responsive Design Testing: responsive designs across devices using browser tools and real world device testing.

Text Book:

1. Ethan Marcotte, *"Responsive Web Design"*, A Book Apart, 2nd Edition, 2014.

Reference Books:

1. Ben Frain, *"Responsive Web Design with HTML5 and CSS"*, Packt Publishing, 4th Edition, 2022.
2. Jonathan Fielding, *"Beginning Responsive Web Design with HTML5 and CSS3"*, Apress, 1st Edition, 2014.
3. Luke Wroblewski, *"Mobile First"*, A Book Apart, 1st Edition, 2011.
4. Jon Duckett, *"HTML and CSS: Design and Build Websites"*, Wiley, 1st Edition, 2011.
5. Jason Cranford Teague, *"CSS3 Visual QuickStart Guide"*, Peachpit Press, 8th Edition, 2015.

E-resources:

1. https://developer.mozilla.org/en-US/docs/Learn/CSS/CSS_layout/Responsive_Design
2. <https://web.dev/responsive-web-design-basics/>
https://www.w3schools.com/css/css_rwd_intro.asp

Elective course V
24PCS215: Time Series and Sequential Data Analysis

Hours/Week: 5

Credits: 4

Internal marks : 25

External marks: 75

Syllabus

Unit I:

Introduction to Time Series and Sequential Data: Fundamentals of Time Series and Sequential Data - Definition and Examples- Time Series vs. Sequential Data vs. Panel Data -Time Series Characteristics: Trend, Seasonality, Cyclic Behavior, and Noise-Time Series Data Representation and Visualization: Line Plots, Lag Plots, Histogram Analysis -Applications of Time Series Analysis: Finance, Healthcare, Weather Forecasting, IoT, Speech Recognition -Data Preprocessing for Time Series: Handling Missing Values, Smoothing Techniques, Resampling

Unit II:

Time Series Decomposition and Modelling : Time Series Components and Decomposition - Additive vs. Multiplicative Decomposition-Moving Average, Exponential Smoothing - Stationarity and Differencing: Augmented Dickey-Fuller (ADF) Test -Transformations (Log, Differencing).

Unit -III

Classical Time Series Models LAuto regressive (AR), Moving Average (MA), ARMA Models: Autoregressive Integrated Moving Average (ARIMA) -Seasonal ARIMA (SARIMA) - Forecasting and Model Evaluation-Performance Metrics: RMSE, MAE, MAPE, AIC, BIC

Unit IV:

Machine Learning and Sequential Pattern Mining :Feature Engineering for Time Series Data - Lag Features, Rolling Statistics, Fourier Transforms -Machine Learning for Time Series Forecasting -Regression-Based Models (Linear Regression, Decision Trees, Random Forests) -Support Vector Regression (SVR) for Time Series -Gradient Boosting Methods – XGBoost-LightGBM -Sequential Pattern Mining -Apriori Algorithm, SPADE, PrefixSpan -Hidden Markov Models (HMM) and Markov Chains -Viterbi Algorithm, Baum-Welch Algorithm - Applications in Speech Processing, Bioinformatics

Unit V:

Time Series and Sequential Data :Gated Recurrent Units (GRU) -Internal Mechanisms of LSTMs and GRUs -Applications in Text and Speech Processing -Transformers for Sequential Data-Attention Mechanisms and Self-Attention -Temporal Fusion Transformers for Time Series

Text Book:

1. George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, Greta M. Ljung, —Time Series Analysis: Forecasting and Controll, Wiley, 5th Edition, 2015.

Reference Book:

1. Robert H. Shumway & David S. Stoffer, Time Series Analysis and Its Applications: With R Examples, *Springer, 5th Edition, 2025.*

2. Aileen Nielsen, Practical Time Series Analysis: Prediction with Statistics and Machine Learning, O'Reilly Media, 1st Edition, 2019
3. Jason Brownlee, Deep Learning for Time Series Forecasting: Predict the Future with MLPs, CNNs, and LSTMs in Python, Machine Learning Mastery, 1st Edition, 2018

Reference Link:

1. <https://bit.ly/ShumwayTimeSeries>
2. <https://bit.ly/BrownleeTimeSeriesDL>

Elective Course VI
24PCS218: Quantum Computing

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus

UNIT I: Fundamental Concepts:

Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.

UNIT – II: Quantum Computation:

Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.

UNIT III: Quantum Computers:

Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance

UNIT IV: Quantum Information:

Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.

UNIT V: Quantum Error Correction:

Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource

Text Book:

1. Michael A. Nielsen & Isaac L. Chuang, —Quantum Computation and Quantum Information: 10th Anniversary Edition, Cambridge University Press, 2010

Reference books:

1. Micheal A. Nielsen. & Issac L. Chiang, —Quantum Computation and Quantum Information, Cambridge University Press, First South Asian edition, 2002.
2. Eleanor G. Rieffel, Wolfgang H. Polak, —Quantum Computing - A Gentle Introduction (Scientific and Engineering Computation) Paperback – Import, 3 Oct 2014

E-Resources:

<https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/>

https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_useful_resources.htm

https://onlinecourses.nptel.ac.in/noc19_cs47/preview

Elective Course VI
24PCS221:Human Computer Interaction

Hours/Week: 5
Internal marks : 25

Credits: 4
External marks: 75

Syllabus:

Unit I: Introduction to Human-Computer Interaction

Definition, scope, and goals of HCI-Evolution of HCI: from command-line interfaces to natural user interfaces-Interdisciplinary nature of HCI: computer science, psychology, design, cognitive science-Components of HCI: human, computer, and interaction-Applications of HCI in various domains -Importance of usability and user experience (UX).

Unit II: Human Factors and Cognitive Models

Human capabilities: perception, memory, attention, and motor skills-Cognitive models: GOMS (Goals, Operators, Methods, and Selection Rules), KLM (Keystroke-Level Model)-Mental models and their influence on system design-Ergonomics and user comfort in interface design-Implications of human factors on HCI design decisions.

Unit III: Design Principles and Interaction Styles

Principles of good interface design: consistency, feedback, visibility, affordance-User-centered design process: analysis, design, prototyping, and evaluation-Interaction styles: command-line, menus, forms, direct manipulation, natural language-Guidelines and standards for interface design - Accessibility and inclusive design principles.

Unit IV: Prototyping and User Interface Development

Types of prototypes: low-fidelity vs high-fidelity--Tools for UI/UX design: Figma, Adobe XD, Balsamiq,etc.-Interface development frameworks and technologies -Iterative design and prototyping techniques-Case studies of successful interface designs.

Unit V: Evaluation Techniques and Emerging Trends

Evaluation methods: heuristic evaluation, cognitive walkthroughs, usability testing-Data collection techniques: surveys, interviews, observation-Quantitative vs qualitative evaluation metrics-Emerging trends in HCI: AR/VR interfaces, wearable tech, voice-based interaction, AI in UX-Ethical and societal considerations in HCI.

Text book:

1. Jenny Preece, Yvonne Rogers, Helen Sharp , "Interaction Design: Beyond Human-Computer Interaction", John Wiley & Sons, 6th edition, 2023.

Reference Book:

1. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale , "Human-Computer Interaction", Pearson Education Limited, 2004 .
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Pearson Education, 6th Edition, 2016

E-References:

1. <https://www.interaction-design.org/literature/topics/human-computer-interaction>