PERIYAR UNIVERSITY
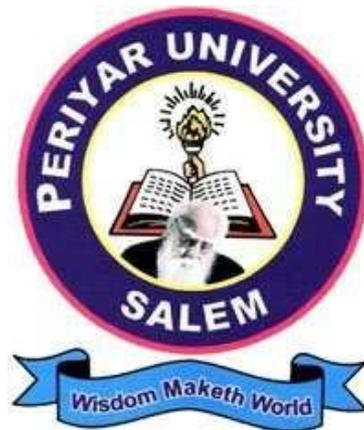
PERIYAR PALKALAI NAGAR

SALEM 636 011

MASTER OF COMPUTER APPLICATIONS (M.C.A)

SEMESTER PATTERN

Under Choice Based Credit System

REGULATIONS AND SYLLABUS

FOR AFFILIATED COLLEGES

(Effective from the Academic year 2021-2022 onwards)

PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM 638 011
Regulations
(FOR AFFILIATED COLLEGES)
Effective from the academic year 2021 - 2022

1. OBJECTIVE OF THE PROGRAMME

Enable the students to pursue lifelong multidisciplinary learning, function effectively on teams to accomplish a common goal and become innovative through technical advancement.

To meet dynamic global needs, the syllabus is focused on technical concepts, to enrich the knowledge of students.

2. CONDITION FOR ADMISSION

Candidates who have passed in any one of the following or equivalent are eligible to apply:

i) Bachelor's degree (under 10+2+3/4) in any subject with Mathematics at +2 level.

ii) Bachelor's degree (under 10+2+3/4 or 10+3 year Diploma + 3 year later entry BE) in any subject with Mathematics / Business Mathematics / Statistics as one of the subjects.

3. DURATION OF THE PROGRAMME

The duration of the degree of Master of Computer Applications shall consist of two academic years divided into four semesters.

4. EXAMINATIONS

The examination shall be of three hours duration for each course at the end of each semester. The candidate failing in any subject(s) will be permitted to appear in the subsequent examination.

The practical / project should be an individual work. The University examination for practical / project work will be conducted by the internal and external examiners jointly at the end of each semester.

5. STRUCTURE OF M.C.A PROGRAMME UNDER CBCS PATTERN FOR AFFILIATED COLLEGES (FROM 2021 AND THEREAFTER)

Curriculum and Scheme of Examinations

Courses	Number of Credits	Hours Per Week	Exam Duration (Hrs.)	CIA	EA	Total
Semester-I						
Core Course-I- Java Programming	4	4	3	25	75	100
Core Course-II- Relational Database Management System	4	4	3	25	75	100
Core Course-III-Discrete Mathematics	4	4	3	25	75	100
Core Course-IV- Advanced Computer Networks	4	4	3	25	75	100
Elective Course – I	4	4	3	25	75	100
Core Course-V - Lab - I - Java Programming Lab	3	5	3	40	60	100
Core Course-VI - Lab - II RDBMS Lab	3	5	3	40	60	100
Semester-II						
Core Course-VII- Data Mining Techniques	4	4	3	25	75	100
Core Course - VIII – Python Programming	4	4	3	25	75	100
Core Course - IX- Advanced Operating System	4	4	3	25	75	100
Elective Course II	4	4	3	25	75	100
EDC –I	4	4	3	25	75	100
Core Course-X-Lab – III Data Mining Lab	3	4	3	40	60	100
Core Course - XI-Lab – IV Python Programming Lab	3	4	3	40	60	100
Human Rights	-	-	3	25	75	100*
Add On Course - SWAYAM/MOOC/SOFT SKILL	3					

Courses	Number of Credits	Hours Per Week	Exam Duration (hrs)	Marks		
				CIA	EA	Total
Semester-III						
Core Course - XII – Internet of Things	4	4	3	25	75	100
Core Course - XIII - .Net Programming	4	4	3	25	75	100
Core Course - XIV - Big Data Analytics	4	4	3	25	75	100
Elective Course III	4	4	3	25	75	100
Elective Course IV	4	4	3	25	75	100
Core Course-XV - .Net Programming Lab	3	5	3	40	60	100
Core Course-XVI – Industry Literacy - Mini Project	3	5	3	40	60	100
Semester-IV						
Core Course-XVII - Project Work and Viva-Voce	15	-	-	100	300	400
Total Core	73			590	1410	2000
EDC	04			25	75	100
Elective	16			100	300	400
Add On Course	03			-	-	-
Human Rights	-			25	75	100*
Grand Total	96			740	1860	2600

* Human Rights mark is excluded for aggregation

ELECTIVES

Elective Course–I

Computer Architecture
Computer Graphics
Design and Analysis of Algorithms
E-Technologies

Elective Course–II

Artificial Intelligence
Theory of Computation
Machine Learning
Web Services

Elective Course–III

Cloud Computing
Embedded System
Social Computing
Virtual Reality

Elective Course–IV

Cyber Security
Data Visualization
Deep Learning
Grid Computing

EDC-EXTRA DISCIPLINARY COURSE
Students are expected to opt EDC (Non major elective) offered by other departments.

1. Principles of Information Technology
2. Fundamentals of Computers and Communications
3. E-Commerce

CIA – CONTINUOUS INTERNAL ASSESSMENT
EA – EXTERNAL ASSESSMENT

6.   EXAMINATIONS

THEORY:
EVALUATION OF CONTINUOUS INTERNAL ASSESSMENT

Test	:	10 Marks
Seminar	:	05 Marks
Assignment	:	05 Marks
Attendance	:	05 Marks
Total	:	25 Marks

(No passing minimum)

EVALUATION OF EXTERNAL ASSESSMENT
QUESTION PAPER PATTERN

Time: 3 Hours   Max. Marks: 75

PART- A: 15x1 = 15 marks
Answer all the questions
Three questions from each unit (Multiple Choice Questions)

PART- B: 2x5 = 10 marks
Answer any TWO questions
One question from each unit

PART- C: 5x10 = 50 marks
Answer all the questions
One question from each unit (either or type)

The Passing minimum shall be 50% out of 75 marks (38 marks)

PRACTICAL / MINI PROJECT :
EVALUATION OF CONTINUOUS INTERNAL ASSESSMENT

Test 1	:	15 Marks
Test 2	:	15 Marks
Record	:	10 Marks
Total	:	40 Marks (**No passing minimum**)

EVALUATION OF EXTERNAL ASSESSMENT
I) PRACTICAL
QUESTION PAPER PATTERN

Time: 3 Hours   Max. Marks: 60

There will be two questions with or without subsections to be asked for the practical examination. Every question should be chosen from the question bank prepared by the examiner(s). Every sixth student should get a new question i.e. each question may be used for at most five students.

Distribution of Marks

Each question	: 30 Marks
Problem Understanding	: 05 Marks
Program writing	: 10 Marks
Debugging	: 10 Marks
For Correct Results	: 05 Marks

II) INDUSTRY LITERACY MINI PROJECT DEVELOPMENT

Viva-voce (Jointly)	: 30 Marks
Modification	: 30 Marks

Students should write about their Mini Project briefly.
  i.   Aim
 ii.   Features
iii.   Modules
 iv.   Modification

III) PROJECT WORK

Continuous Internal Assessment	: 100 Marks
Evaluation & Viva-Voce (External)	: 300 Marks

7.   REGULATIONS OF PROJECT WORK
- Students should do their Project work in a MNC Company / Research Institution during the **IV semester**
- The Candidate should submit the filled in format as given in Annexure-I to the department for approval during the Ist week of December.
- Periodically the project should be reviewed.
- The Student should submit three copies of their Project Report.
- A Sample format is enclosed in Annexure-II.
- Format of the Title page and Certificate are enclosed in Annexure III.
- The students may use power point presentation during their viva voce examination.

8. PASSING MINIMUM

The candidate shall be declared to have passed in the Theory / Practical / Project Work examination, if the candidate secures not less than 50% marks in EA and also in Total of the prescribed marks. However submission of a record notebook is a must.

9. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who obtain 75% and above in the aggregate shall be deemed to have passed the examination in **First Class with Distinction** provided they pass all the examinations prescribed for the programme at the first appearance. Candidates, other than the above, who secure not less than 60% of the aggregate marks in the whole examination, shall be declared to have passed the examination in **First Class**. The remaining successful candidates shall be declared to have passed in **Second Class**.

Candidates who pass all the examinations prescribed for the programme in first instance and within a period of two academic years from the year of admission are only eligible for University Ranking.

10. MAXIMUM DURATION FOR THE COMPLETION OF THE PROGRAMME

The maximum duration to complete the programme shall be three academic years after normal completion of the programme.

11. COMMENCEMENT OF THIS REGULATION

These regulations shall take effect from the academic year 2021-22, that is, for students who are admitted to the first year of the programme during the academic year 2021-22 and thereafter.

12. TRANSITORY PROVISION

Candidates who were admitted to the MCA programme of study before 2021-2022 shall be permitted to appear for the examinations under those regulations for a period of three years after completion of the programme. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

PERIYAR UNIVERSITY

Name of the College   :

Programme   :

Name of the Student   :

Register Number   :

Title of the Project Work   :

Address of Organization / Institution :

Name of the External Guide   :

Designation   :

Place :

Date :   Signature of External Guide

(with seal)

Name of the Internal Guide   :

Qualification   :

Teaching Experience   :

Place :

Date :   Signature of Internal Guide

Principal

[Approved or not Approved]

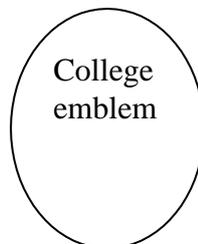[University Use]

CONTENTS

A. Format of the title page

TITLE OF THE PROJECT WORK

A Project Work submitted in partial fulfillment of

the requirements for the degree of

Master of Computer Applications

to the

Periyar University, Salem - 11

By

NAME OF THE STUDENT

REG. NO.

College emblem

COLLEGE NAME

(AFFILIATED TO PERIYAR UNIVERSITY)

PLACE with Pin Code

MONTH – YEAR

B. Format of the Certificate

Name and Address of the Internal Guide

Place

Date

CERTIFICATE

This is to certify that the Project Work entitled ……............................. ....……… submitted in partial fulfillment of the requirements of the degree of Master of Computer Applications to the Periyar University, Salem is a record of bonafide work carried out by ....……… Reg. No ....under my supervision and guidance.

Internal Guide

Head of the Department

Date of Viva-voce:

Internal Examiner

External Examiner

Core Course-I-JAVA PROGRAMMING

OBJECTIVES:

- To Understand the OOPS concept and how to apply in programming
- To understand and apply the fundamentals core java, packages, and database connectivity
- Helps to develop web based applications and Learn the advanced concepts of Java

UNIT – I

OOP and Java: OOP Principles – Introduction to Java Language – Data Types, Arrays, Operators, Control Statements – Creating and Executing a Simple Java Applications Programs. **Classes and Objects**: Introduction – General From of a class - Object Creation – Methods – Methods Overloading – Constructors. **Multithreading**: Java Thread Model-Main Thread-Creating a Thread-Creating Multiple Threads-Using isAlive() and join()-Synchronization-Interthread Communication-Suspending, Resuming and Stopping Threads-Using Multithreading.

UNIT – II

I/O Exploring java.io: Java I/O classes and interfaces-File-Closeable and Flushable Interfaces-The stream classes-Byte Streams-Character Streams-Console Class-Using Stream I/O-Serialization. **Networking**: Basics-Networking classes and interface-Inet Address-Inet4 Address and Inet6AddressTCP/IP Client Socket-URL-URL connection-http URL Connection-URI class-Cookies TCP/IP server socket-Datagrams. **Event Handling**: Event Handling mechanisms-Delegation Event model-Event classes-Source of Events-Event Listener Interfaces-Using delegation Event model-Adapter classes-Inner classes.

UNIT – III

AWT: AWT classes-Window Fundamentals-Working with frame windows-Creating a frame window in an applet-Creating a windowed program-Displaying information within a window-Working with Graphics, color and font-Managing text output using font metrics. **AWT Controls**: Control Fundamentals, Labels, Using Buttons, Checkboxes, Choice Control, List ,Scroll Bars and Text Field, AWT Layouts and Menus: Understanding Layout Managers - Menu Bars and Menus-Dialog Boxes-File Dialog-Handling Events. **Swing**: Features of Swing-MVC Connection-Components and containers-Swing packages-Event handling-Creating a swing-Exploring swing.

UNIT – IV

Networking: Basics-Networking classes and interface-Inet Address-Inet4 Address and Inet6AddressTCP/IP Client Socket-URL-URL connection-http URL Connection-URI class-CookiesTCP/IP server socket-Datagrams .**RMI:** Introduction – Remote Interface – java.rmi.Server Packages – Naming Class – RMI Exception – Creating a simple RMI Client and Server application**. JDBC**: Introduction – JDBC architecture – JDBC drivers – Writing JDBC applications – Statements objects – Result Set – Inserting and uploading records.

UNIT – V

Servlet: Introduction to servlet - Developing and Deploying Servlets - Handling Request and Response - Reading Servlet Parameters - Cookies - Session Tracking. **Java Server Pages**: Basic JSP Architecture - Life Cycle of JSP - JSP Tags and Expressions – Directives- JSP applications. Java Creating and using JavaBean components –Setting and retrieving JavaBean components – Java Server Faces Application.

TEXT BOOKS

1. Herbert Schildt, ―The Complete Reference, Seventh Edition, Tata McGraw-Hill
2. Deitel H.M. & Deitel P.J, "Java: How To Program," Prentice-Hall of India, 5th Edition, 2003.
3. KogentSolutionss, Java Server Programming Java Ee5 Black Book,Dreamtech Press, 2008

REFERENCE BOOKS

1. S.Gokila, "Advanced JAVA Programming," Vijay Nicole Imprints Private Ltd., 2014
2. Tom Valesky, "Enterprise JavaBeans – Developing component based Distributed Applications," Pearson 2000.
3. C.Muthu, "Programming with Java," Vijay Nicole Imprints Private Ltd., 2004

COURSE OUTCOMES:

• Able to understand Object Oriented Programming concepts, java and Applet programming.
• Develops learners knowlege to create client / server application, developing Java Beans and Servlet applications.

Core Course-II- RELATIONAL DATABASE MANAGEMENT SYSTEM

OBJECTIVES:
- To understand the architecture and functioning of relational, distributed and object oriented databases
- To learn the use of structural query language and its syntax, transactions and techniques for query optimization

UNIT - I

Introduction – purpose of database system - data models – database languages - Transaction management – Storage management - DBA –database users - system structure, E-R model.

UNIT - II

Relational Database Design: Anomalies in a Database – Functional Dependency – Lossless Join and Dependency – Preserving Decomposition – Third Normal Form – Boyce Codd Normal Form – Multivalued Dependency – Fourth Normal Form – Join Dependency – Project Join Normal Form – Domain Key Normal Form. SQL: Data Definition – Data Manipulation – Integrity Constraints– Views–PL/SQL.

UNIT - III

Indexing and Hashing – Query Processing – Transaction Processing – Concurrency Control and Recovery.

UNIT - IV

Advanced Database Concepts and Emerging Applications: Distributed Databases – Object Oriented Databases - Object Relational Databases- Data mining and Data Warehousing.

UNIT – V

DBMS Case Studies: Application of DB concepts in Hospitals or any small and medium scale Industry– Application of DBMS in Marketing (For Unit V, students are expected to do a survey and study and submit a report)

REFERENCE BOOKS

1. Abraham Silberchatz, Henry K.Forth, Sudharshan, "Database system Concepts" – (6th edition), McGraw Hill, 2010.

2. Elisa Bertino, "Object Oriented Databases", Addison Wesley. 1993.

3. RamezElmasri, ShamkantB.Navathe, " Fundamentals of Database Systems ", 3rd Edition, Addison Wesley-2000.

4. Malay k. Pakhira, "Database Management System", Phi Learning Pvt. Ltd., 2012.

ONLINE RESOURCES / TUTORIALS

1. http://nptel.ac.in/courses/106106093/

2. https://www.tutorialspoint.com/dbms/

3. http://www.db-book.com/

4. http://www.w3schools.in/dbms/

5. http://www.sanfoundry.com/1000-database-management-system-questions-answers/

6. https://onlinecourses.nptel.ac.in/noc21_cs04/preview

7. https://onlinecourses.swayam2.ac.in/aic20_sp36/preview

8. https://onlinecourses.swayam2.ac.in/cec21_cs11/preview

9. https://onlinecourses.swayam2.ac.in/nou21_lb02/preview

10. https://onlinecourses.nptel.ac.in/noc21_cs52/preview

COURSE OUTCOMES:

On completion of the course, students will able to

- Know about the various Data models and works on Database Architecture
- Knowledge patterns, Object Oriented Databases are well equipped.

CORE COURSE – III - DISCRETE MATHEMATICS

OBJECTIVES:

- Define proposition & logical connectives.
- Describe the logical equivalence and implications.
- To study predicate and quantifier.
- Discuss Fundamental principle of counting, permutation and combination

UNIT-I

Mathematical Logic : Statements and notation - Connectives - Conditional and Biconditional - Normal Forms - The Theory of Inference for the Statement Calculus – The Rules of Inference - The Predicate Calculus – The Statement Functions, Variables and Quantifiers – Problems.

UNIT-II

Relation and Ordering : Properties of Binary Relations in a set – Partition and Covering of a Set - Equivalence Relations – Partial ordering – Partially ordered Set – Problems.
Functions : Introduction and Definition – Composition of Functions – Inverse Functions – Binary and n- ary operations - Hassing Functions – Problems.

UNIT-III

Counting : The Basics of Counting – The Pigeonhole Principle – Permutations and Combinations – Binomial Coefficients – Generalized Permutations and Combinations – Generating Permutations and Combinations – Problems.

UNIT –IV

Boolean Algebra : Boolean Functions – Boolean Expressions – Boolean Equivalence – Duality - Representing Boolean Functions – Logic Gates – Minimization of Circuits – Problems.

UNIT-V

Graph Theory and Trees : Introduction – Basic Concepts of Graph Theory – Basic Definitions – Paths, Reachability and Connectedness – Matrix representation of Graphs – Trees - Storage Representation and Manipulation of Graphs - Trees: Their Representation and operations – List Structures and Graphs – Problems.

TEXT BOOK

1. J. P. Tremblay and R. Manohar : "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill Edition 1997. [Unit – I, II,V]
2. Kenneth H. Rosen : "Discrete Mathematics and Its Applications", Seventh Edition. [Unit- III and IV]

REFERENCE BOOKS

1. J. A. Bondy and U.S.R. Murty : Graph Theory with Applications, North Holland, New York, 1982.
2. L. Liu : Elements of Discrete Mathematics, Second Edition, TMH 2000.

COURSE OUTCOMES:

After completion of this course, students will be able to

- Apply concept of Predicate Calculus in computer science like design of computing machines, artificial intelligence, definition of data structures for programming languages etc. (Application)
- Apply the knowledge of Boolean algebra in computer science for its wide applicability in switching theory, building basic electronic circuits and design of digital computers. (Knowledge, Application)
- Understand the application of various type of graphs in real life problem.(Knowledge, Comprehension)

Core Course-IV-ADVANCED COMPUTER NETWORKS

OBJECTIVES:

- To study communication network protocols, different communication layer structure

- To learn security mechanism for data communication

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOKS

1. Andrew S. Tanenbaum, "Computer Networks", Pearson Education, Inc., 5th Edition 2011.

REFERENCE BOOKS

1. Forouzan, "Introduction to Data Communications in Networking", Tata McGraw Hill, New Delhi, 1998.
2. Halsall, "Data Communications, Computer Networks and Open Systems", Addison Wesley, 1995.
3. Bertsekas and R. Gallagher, "Data Networks", Prentice hall of India, New Delhi, 1992.
4. Lamarca, "Communication Networks", Tata McGraw Hill, New Delhi, 2002.
5. Teresa C.Piliouras,"Network Design Management and Technical Perspectives", Auerbach Publishers,Second Edition 2015.
6. http://peasonhighered.com/tanenbaum

COURSE OUTCOMES:

- Remember the basic concept about the fundamentals of computer networks.
- Understand Error detection and correction in Data link layer.
- Analyze the ADSL and Medium Access Layer.
- Understand about the service provided by the Network layer and apply algorithms.
- Analyze Error control, flow control in Transport Layer.

SEMESTER I

Core Course - V - LAB – I JAVA PROGRAMMING LAB

1. Write a java application program to demonstrate class with constructors.
2. Write a java application program to demonstrate inheritance, interface and package.
3. Write a java application program to implement exception and Multi threading concept.
4. Write a program to read, write and copy a file using byte streams or character streams.
5. Develop a banking system using AWT and event handling.
6. Develop a programs using Swing to display the personal detail of an employee.
7. Implement TCP/IP and UDP protocol for message communication.
8. Using JDBC develop a student information system.
9. Implement client/server communication using servlets.
10. Develop a web page using JSP.

SEMESTER I

Core Course - V - LAB – II RELATIONAL DATABASE MANAGEMENT SYSTEM LAB

1. Creation of a database and writing SQL queries to retrieve information from the database.

2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.

3. Creation of a database and perform the operations Views, Synonyms, Sequence, Indexes, Save

4. Creating an Employee database to set various constraints.

5. Creating relationships between the databases.

6. Write a PL/SQL block for a database and retrieve records from the database using cursor.

7. Write a PL/SQL block to satisfy some conditions by accepting input from the user.

8. Write a PL/SQL block that handles all types of exceptions.

9. Creation of procedures for a database and perform some operations.

10. Creation of database and perform the following operations:

    a. Insert a record to a database using triggers

    b. Group the records from a database using functions.

Core Course –VII – DATA MINING TECHNIQUES

OBJECTIVES:

- To introduce the fundamental concepts of Data Mining techniques
- To understand the various algorithms used for Information Retrieval from Datasets

UNIT-I

Data Mining And Data Preprocessing : Data Mining - Definition – Kinds of Data Mining - Patterns – Major Issues in data mining – Data Preprocessing – Definition – Data Cleaning – Data Integration and Reduction – Data Transformation.

UNIT -II

Data Warehousing: Basic Concepts – Multidimensional Data Model- Data Warehouse Architecture – Data Warehouse Design and Usage – Data Warehouse Implementation.

UNIT –III

Frequent Patterns, Associations and Classifications: Basic Concepts – The Apriori Algorithm – Definition of Classification – Decision tree Induction – Bayesian Classification Method - Rule Based Classification – Classification by Back Propagation – Lazy Learners – K-Nearest Neighbor– other Classification Methods.

UNIT -IV

Cluster Analysis: Definition – Requirements for Cluster Analysis – Categorization of major Clustering Techniques - Partitioning Methods – Hierarchical Methods – Grid Based Methods – Model Based Clustering - Outlier Analysis.

UNIT –V

Data Mining Trends and Applications: Spatial Data Mining – Multimedia Data Mining – Web Data Mining – Data Mining Applications – Data Mining Trends.

TEXT BOOKS

1. Jiawei Han and Micheline Kamber. " Data Mining Concepts and Techniques", Third Edition July 6, 2011.
2. Ian H. Written, Eibe Frank, Mark A. Hall, "Data Mining: Practical Machine Learning Tools And Techniques", Elsevier Third Edition, 2014.

REFERENCE BOOKS

1. Margret H. Dunham, "Data Mining: Introductory and Advanced Topics" Pearson Education, 2003.
2. M. Awad, Latifur Khan, Bhavani Thuraisingham, Lei Wang, "Design and Implementation of Data Mining Tools", CRC Press – Taylor & Francis Group, 2015.
3. Pang- Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining – instructors Solution Manual" , Pearson Education, First Edition, 2016.
4. MohammedJ.Zaki, Wagner Meira JR, "Data Mining and Analysis: Fundamental Concepts and Algorithms" , Cambridge India, 2016.

COURSE OUTCOMES:

- After completing this course, Students will be familiar with basic data mining concepts
- Can solve the real world problems through data mining approach
- Can find the hidden and useful information from the large dataset

Core Course –VIII – PYTHON PROGRAMMING

OBJECTIVES:

- The main aim of the course is to introduce multi paradigms of programming language using python programming language
- The course introduces core components of different paradigms of programming language like interactive, logic and functional
- The Course introduces core components of object oriented and web programming based on python language

UNIT - I

Introduction to Multi paradigm approach using Python : Overview of programming paradigms-Imperative, Functional, logic and object oriented Introduction to Python programming Language- Features, Downloading and Installing, Running Python, Python Documentation, Python Basics- The print statement, comment, statements and syntax, variable assignments ,identifier.

UNIT – II

Objects, Numbers and Sequences in Python : Python Objects- Standard types, Other built-in types, Internal types, Numbers- Integer, Double precision floating point, complex numbers, operators, Sequences- String, List and Tuples.

UNIT – III

Conditional, loops and files: If, else, elif, conditional expressions, while, for, break , continue, pass, File objects, File built in functions, standards files, command line arguments

UNIT - IV

Functional programming: Creating Functions, Passing Functions, Functional Programming, Scope of variables, Introduction to Modules, Modules and Files, Importing Modules, Module Built-in functions, packages, Other features of modules

UNIT – V

Object Oriented Programming : Classes, Classes attributes, Instances, Instance attributes, Binding and Method Invocation, Static and Class methods, Inheritance, Built-in functions for classes, instances and other objects Unit VI: Web Programming Hours: 08 Introduction, Creating Simple Web Client, Advanced Web Clients, CGI, Building CGI Applications.

TEXT BOOKS

1. Wesley J. Chun : Core Python Programming, 2nd edition, Prentice Hall,2006.
2. Megnus Lie Hetland : Beginning Python from novice to professional, 2nd edition, Apress,2009.

REFERENCE BOOKS

1. Mark Lutz : Programming Python, 4thEdition,O'reilly, 2011 .

2. Dusty Philips: Python 3 Object oriented Programming , PACKT publishing, 2010.

3. Steve Holden: Python Web Programming, 1st edition,2002.

COURSE OUTCOMES:

- Able to understanding Python scripting language

- Clear Understanding of the built-in objects of Python and object-oriented concepts

- Express different Decision Making statements and Functions

- Be exposed to advanced applications such as Web applications

Core Course –IX – ADVANCED OPERATING SYSTEM

OBJECTIVES:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating systems

UNIT - I

Fundamentals of operating systems: Overview - Synchronization mechanisms – Process and T-Threads – Process Scheduling – Deadlocks: Detection, Prevention and recovery – Models of Resources – Memory Management.

UNIT – II

Distributed Operating Systems: Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT – III

Distributed Resource Management: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection.

UNIT - IV

Real Time And Mobile Operating Systems: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

UNIT – V

Case Studies: Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System - Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

REFERENCE BOOKS

1. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems
   – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill,
   2001

2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts",
   Seventh Edition, John Wiley & Sons, 2004

3. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition,
   O'Reilly, 2005

4. Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006

5. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload
   media, 2011

COURSE OUTCOMES:

- Discuss the various synchronization, scheduling and memory management issues
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Discuss the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Install and use available open source kernel
- Modify existing open source kernels in terms of functionality or features used

SEMESTER II

Core Course - X - LAB – III DATA MINING LAB

(Using any Open Source Data Mining Tool)

1. To get the Input from user and Perform Numerical Operations [MAX, MIN, AVG, SUM, SQRT, ROUND].
2. Implement the FP– Growth algorithm.
3. To get the input from user and perform Addition and Subtraction, Multiplication.
4. To Perform Statistical Operations [Mean, Median, Mode and Standard Deviation].
5. To generate a decision tree for the given data set.
6. Develop an application to extract association mining rules.
7. Develop an application for implementing one of the clustering techniques.
8. To Perform K-means Clustering Operations and Visualize it.
9. Develop an application for implementing Naive Bayes classifier.
10. To Perform Market Basket Analysis using Apriori algorithm.

SEMESTER II

Core Course - XI-Lab – IV PYTHON PROGRAMMING LAB

1. Write a Python program to get the smallest number from a list.

2. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.

3. Write a Python program to get a list, sorted in increasing order by the last element in each tuple from a given list of non-empty tuples.

4. Write a Python program to print a specified list after removing the 0th, 4th and 5th elements..

    a. Sample List : ['Red', 'Green', 'White', 'Black', 'Pink', 'Yellow']
       Expected Output : ['Green', 'White', 'Black']

5. Write a Python program to compute the difference between two lists.
   Sample data: ["red", "orange", "green", "blue", "white"], ["black", "yellow", "green", "blue"]
   Expected Output:
   Color1-Color2: ['white', 'orange', 'red']
   Color2-Color1: ['black', 'yellow']

6. Write a Python program to concatenate elements of a list.

7. Write a Python program to read a matrix from console and print the sum for each column. Accept matrix rows, columns and elements for each column separated with a space(for every row) as input from the user.

8. Write a Python program to check if first digit/character of each element in a given list is same or not.

9. Write a Python program to check if a given string contains an element, which is present in a list.

10. Write a Python program to compute the average of nth elements in a given list of lists with different lengths.

Core Course - XII – INTERNET OF THINGS

OBJECTIVES:
- Understand the IOT Terminology and Technology
- Describe IOT applications
- Analyze Protocol standardization for IOT
- Identify the role of cloud computing in IOT
- To apply the concept of Internet of Things in the real world scenario

UNIT - I

Introduction, Design and Technologies: Introduction- Definition & Characteristics of IoT – Physical design of IoT-Things in IoT and IoT protocols -logical Design of IoT- IoT Functional Blocks-IoT Communication Model and IoT Communication APIs - IoT Enabling Technologies - Wireless Sensor Networks -Cloud Computing- Big Data Analytics - Communication Protocols-Embedded Systems- IoT Levels & Deployment Templates.

UNIT – II

Domain, M2m and System Management: Introduction- Home Automation – Cities - Industry- Health & Lifestyle- M2M-SDN and NFV for IoT - Software Defined Networking - Network Function Virtualization- IoT System Management- Need for IoT Systems Management -Simple Network Management Protocol -Limitations of SNMP - Network Operator-Requirements.

UNIT – III

Protocols: Infrastructure - 6LowPAN- IPv6, Identification - EPC-uCode-URIs,Comms / Transport - Wifi, Bluetooth- LPWAN,Discovery- Physical Web- DNS-DNS-SD,Data Protocols – MQTT-CoAP- AMQP- Websocket- Node,Device Management ,Semantic -JSON-LD.

UNIT - IV

Developing Internet Of Things For Real-World Applications: IoT Platforms Design Methodology - IoT System for Weather Monitoring – IoT System for Agriculture. Introduction to Cloud Storage Models & Communication APIs -WAMP - Cloud for IoT - Real world design constraints - Applications -, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs.

UNIT – V

Cloud Services ForIot: Designing a RESTful Web API -Amazon Web Services for IoT –EC2-Autoscaling-S3- RDSDynamoDB-Kinesis-SkyNetIoT Messaging Platform.Dynamics: Structural Models, Cascading Behaviour in Networks, The Small-World Phenomenon; Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT.

TEXT BOOKS

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015

REFERENCE BOOKS

1. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011

2. CunoPfister, "Getting Started with the Internet of Things", O'Reilly, 2011

3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014.

4. HonboZhou , "The Internet of Things in the Cloud: A Middleware Perspective ", CRC Press , 2012

5. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.

COURSE OUTCOMES:

- Demonstrate the design, communication model and enabling technologies for IoT.
- Explore the system management and domain for various applications of IoT.
- Categorize the various protocols that are used for developing IoT applications.
- Deploy an IoT application and connect to the cloud.
- Develop IoTapplications for real time scenario.

Core Course - XIII - .NET PROGRAMMING

OBJECTIVES:

On completion of the course, the students will

- Have knowledge on .Net Framework, building form with web controls creating and using Rich Controls, Validation Controls and ADO.Net.
- be able to develop the .Net based applications

UNIT I

Introducing C# and the .NET platform: The philosophy of .Net - Introducing the building blocks of the .Net platform (CLR, CLS and CTS) - .Net assemblies – Common type system - Namespaces/types distinction.

UNIT II

Core C# Programming Constructs: Environment class – System. Console class - String-Data type Conversion - C# iteration constructs-Decision Constructs - methods - arrays-structure - understanding values types and reference types - C# nullable.

UNIT III

Object Oriented Programming with C#: Introducing the C# class type - understanding constructor - this keyword - static keyword - defining pillars of OOP - C# access modifiers-inheritance and polymorphism-understanding exception handling-understanding object lifetime - working with interfaces – delegates – events - Introducing LINQ.

UNIT IV

Windows Forms: windows forms fundamentals-windows MDI forms-Handling events-Adding Controls to forms. Windows Controls: Textboxes – labels – Linkablebutton – checkboxes – radiobuttons – ListBoxes – CheckedListBoxes – ComboBoxes - PictureBox – ImageList – DateTimePicker – ListView – Richtextbox – Toolbars - TabControl-MenuStrip. Advanced Window Programming: File Handling.

UNIT V

Data Access with ADO.NET: ADO.Net Architecture – Advantages - ADO.Net Objects. Handling Databases in code: Connection class-Command class – DataAdapter – DatasetClass - DataReader class - DataTable Class - DataRow, DataColumn classes – Datarelation Class.Handling Data Manipulation in code: Record navigation-record updation - inserting record - deleting record.

TEXT BOOKS

1. Andrew Troelson, "C# 2010 and .Net Platform", A press, 6 th Edition, 2010 (Unit I, II,III)

2. J. G. R. Sathiaseelan and N. Sasikaladevi, "Programming with C#.Net", Pearson Education, 1 st   Edition, 2009 (Unit-IV& V)

REFERENCE BOOKS

1. Herbert Schildt, "The Complete Reference: C#", Tata McGraw Hill Publications, 2004.

2. E. Balagurusamy, "Programming in C#", Tata Mc-GrawHill Publications, 2 nd Edition 2009.

COURSE OUTCOMES:

At the end of the course the students must be able to :

- Understand the development and deployment cycles of enterprise applications.

- Utilize the .NET framework to build distributed enterprise applications.

- Understand the c# Programming Constructs.

- Develop web applications using a combination of client-side and server-side technologies.

- Understand and experiment with the deployment of enterprise applications.

Core Course - XIV – BIG DATA ANALYTICS

OBJECTIVES:

- To impart knowledge in Fundamentals, Big Data Analytics, Technologies and databases, Hadoop and Map Reduce Fundamentals

UNIT - I

Introduction to big data: Data, Characteristics of data and Types of digital data: Unstructured- Semi-structured and Structured- Sources of data- Working with unstructured data- Evolution and Definition of big data- Characteristics and Need of big data- Challenges of big data- Data environment versus big data environment.

UNIT – II

Big data analytics: Overview of business intelligence- Data science and Analytics- Meaning and Characteristics of big data analytics- Need of big data analytics- Classification of analytics- Challenges to big data analytics- Importance of big data analytics- Basic terminologies in big data environment.

UNIT – III

Big data technologies and Databases: Introduction to NoSQL- Uses- Features and Types- Need Advantage- Disadvantages and Application of NoSQL- Overview of NewSQL- Comparing SQL- NoSQL and NewSQL- Introduction to MongoDB and its needs- Characteristics of MongoDB- Introduction of apache cassandra and its needs- Characteristics of Cassandra.

UNIT - IV

Hadoop foundation for analytics: History- Needs- Features- Key advantage and Versions of Hadoop- Essential of Hadoop ecosystems- RDBMS versus Hadoop-Key aspects and Components of Hadoop- Hadoop architectures.

UNIT – V

HadoopMap Reduce and YARN framework: Introduction to MapReduce- Processing data with Hadoop using MapReduce- Introduction to YARN- Components, Need and Challenges of YARN- Dissecting YARN- MapReduce application- Data serialization and Working with common serialization formats- Big data serialization formats.

TEXT BOOKS

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt. Ltd., 2016

REFERENCE BOOKS

2. "Big Data" by Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman, Wiley Publications, 2014

3. "Big Data Imperatives : Enterprise Big Data Warehouse, BI Implementations and Analytics" by Soumendra Mohanty, Madhu Jagadeesh and Harsha Srivatsa, Apress Media, Springer Science + Business Media New York, 2013

4. "Mining of Massive Datasets", Anand Rajaraman, Jure Leskovec, Jeffery D. Ullman, Springer, July 2013

5. "Hadoop: The definitive Guide", Tom White, O'Reilly Media, 2010.

COURSE OUTCOMES:

At the end of the course the students must be able to:

- Understand big data analytics as the next wave for businesses looking for competitive

- Understand the financial value of big data analytics

- Explore tools and practices for working with big data

- Understand how big data analytics can leverage into a key component

- Know about the research that requires the integration of large amounts of data

SEMESTER III

Core Course-XV-PROGRAMMING IN C#.NET LAB

1. Develop a project to update and delete few records using Disconnected Access.

2. Develop a project to view the records using GridView, DetailsView, FormViewControls.

3. Develop a project to generate a crystal report from an existing database.

4. Design a web page that makes uses of Ad Rotator Control.

5. Design a web page involving Multi View or Wizard Control.

6. Make use of Image Control involving two hot spots in a web page.

7. Establish the security features in a simple web site with five pages.

8. Use state management concepts in a mobile web application.

9. Develop a web service that has an ASP.Net client.

10. Develop a web service to fetch a data from a table and send it across to the client.

Core Course-XVI – INDUSTRY LITERACY - MINI PROJECT

OBJECTIVES:

- To undergo an Internship with any company to plan, analyze, design and implement a software project done within a stipulated period of time

The students are expected to undergo an Internship programme with any Industry / organization during the summer vacation of their II Semester with a stipulated period of minimum 20 days. The company must be a standard and registered body under Private / Public Act.

The student must submit a report to the Guide allotted to them during the III semester and the student has to appear for viva voce examination. The project report may contain the following:

1. Introduction

2. Data Collection / system study

3. System development

4. Implementation

   • Source code

   • Sample input

   • Sample output

5. Conclusion

SEMESTER – IV

Core Course - XVII - PROJECT WORK AND VIVA-VOCE

The students are expected to do their dissertation for one full semester by attaching themselves with a well reputed Organization/Research Institution and should submit the filled in format as given in Annexure-I to the department for approval of their Guide during the First Week of December. Periodically the project should be reviewed. The three copies of the project report should be submitted as per the format provided in Annexure II. Format of the Title page and Certificate are enclosed in Annexure III

Elective Course – I COMPUTER ARCHITECTURE

OBJECTIVES:

- To understand the fundamental knowledge for digital systems, the structure, function and characteristics of computer systems
- To identify and compare different methods for computer I/O
- To understand the basic principle of the assembly language and micro operations
- To identify the pipelining as a basic technique for increasing CPU performance as well as design, planning and control of pipeline units

UNIT - I

Boolean Algebra- Logic Gates - Simplification of Logic Circuits: Algebraic Simplification - Karnaugh Maps - Combinational Circuits: Adders – Mux - De-Mux - Sequential Circuits: Flip-Flops (SR, JK & D) - Counters: synchronous and asynchronous Counter - Comparison of Computer Organization &Architecture - Computer Components and Functions - Bus Interconnections - Input / Output: I/O Module - Programmed I/O - Interrupt Driven I/O - Direct Memory Access

UNIT - II

Classification and design parameters - Memory Hierarchy - Internal Memory: RAM - SRAM and DRAM - Interleaved and Associative Memory. Cache Memory: Design Principles - Memory mappings - Replacement Algorithms - Cache performance - Cache Coherence - Virtual Memory - External Memory: Magnetic Discs - Optical Memory - Flash Memories - RAID Levels

UNIT - III

Instruction Formats - Instruction Sets - Addressing Modes - Addressing Modes Examples with Assembly Language [8085/8086 CPU] - Processor Organization, Structure and Function - Register Organization - Instruction Cycle - Instruction Pipelining - Introduction to RISC and CISC Architecture - Instruction Level Parallelism and Superscalar Processors: Design Issues.

UNIT - IV

Micro-Operations - Functional Requirements - Processor Control - Hardwired Implementation - Micro-programmed Control - Multi-Processor Organization - Parallel Processing: Concept and Block Diagram - Types (SISD, SIMD, Interconnect network, MIMD, MISD) - Future Directions for Parallel Processors - Performance of Processors

UNIT - V

Pipelining Data Path - Time Space Diagram – Hazards - Instruction Pipelining - Arithmetic Pipelining.

TEXT BOOK

1. Computer System Architecture, M. Morris Mano, Pearson Education.

2. Computer Organization & Architecture, William Stallings, 8e, Pearson Education

REFERENCE BOOKS

1. Computer Organisation and architecture- Pal Chaudhary

2. Structured computer organization- Tanenbaum

3. Computer Architecture & Organization, John P. Hayes, 3e, Tata McGraw Hill

COURSE OUTCOMES:

On completion of the course, student will be able to:

- Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os
- Understand the potential of a hierarchical memory system
- To develop logic for assembly language programming
- Develop design skills of Instruction Sets
- Know how to design a pipelined data path

OBJECTIVES:

- To understand the development of graphics with mathematics

- To comprehend the fundamental concepts about display devices, input devices and graphics system.

- To imbibe knowledge of display systems, image synthesis, shape modeling of 2D and 3D applications

UNIT – I

Overview of Graphics Systems: Video Display Devices – Input Devices – Hard Copy Devices –Graphics Software – Introduction to OpenGL. Graphics Output Primitives: Line–Drawing Algorithms –Line Equations–DDA Algorithm–Bresenham's Algorithm – Circle– Generating Algorithms.

UNIT – II

Attributes of Graphics Primitives: Color and Gray Scale – Line Attributes–Fill–Area Attributes – Character Attributes – Antialiasing. – OpenGL Color Functions. Geometric Transformations: Basic Two Dimensional Geometric Transformations – Matrix Representations and Homogeneous Coordinates.

UNIT – III

Two–Dimensional Viewing: The Clipping Window –Clipping Algorithms–Two Dimensional Line Clipping–Polygon Fill–Area Clipping –Curve Clipping –Text Clipping. Interactive Input Methods and Graphical User Interfaces: Logical Classification of Input Devices – Interactive Picture Construction Techniques.

UNIT – IV

Three Dimensional Viewing: The Three–Dimensional Viewing Pipeline– Three–Dimensional Viewing–Coordinate Parameters Transformation from World to Viewing Coordinates– Projection Transformations– Perspective Projections– OpenGL Three Dimensional Viewing Functions.

UNIT – V

Visible–Surface Detection Methods: Classification of Visible–Surface Detection Algorithms– Comparison of visibility–Detection Methods–Curved Surfaces–Wire–Frame Visibility Methods. **Computer Animation:** Design of Animation Sequences –Traditional Animation Techniques – General Computer–Animation Functions – Computer Animation Languages – Key-Frame Systems – Motion Specifications.

TEXT BOOK

1. Donald Hearn, M.Pauline Baker, Computer Graphics with OpenGL, Pearson Education, Third Edition, 2009.

2.Donald Hearn, M. Pauline Baker, "Computer Graphics", Second Edition, Pearson Education, Asia, Delhi, 2002.

REFERENCE BOOKS

1. Newman William M., Sproull Robert F., Principles of Interactive Computer Graphics, McGraw Hill, 2010.

2. Steven Harrington, Computer Graphics – A Programming Approach‖, McGraw Hill, 1983.

3. John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, Kurt Akeley, Computer Graphics: Principles and Practice‖, Addison-Wesley Professional; 3rd edition, 2013.

COURSE OUTCOMES:

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

- To understand the activities involved in modeling, rendering, shading and animation of computer graphics

- To use Open GL to create interactive computer graphics

- To understand a typical graphics pipeline and make pictures with their computer

Elective Course - I- DESIGN AND ANALYSIS OF ALGORITHMS

OBJECTIVES:

- To learn about Complexity Analysis and various algorithmic design methodologies
- To critically analyse the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques
- To understand the limitations of Algorithmic power

UNIT - I

Introduction: Algorithm - Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types - – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and theirproperties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive andNon-recursive algorithms

UNIT - II

Brute Force – Computing a^n– String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers.

UNIT - III

Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem - Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees.

UNIT - IV

Backtracking – n-Queen's problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem. Lower Bound Theory – Lower Bounds through Reductions

UNIT - V

NP-Hard and NP-Complete Problems - Approximation of algorithms: Absolute approximations- Approximation Algorithms for NP-Hard Problems - €-Approximations.

TEXT BOOKS

1. Anany Levitin, -"Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.

2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2007.

REFERENCE BOOKS

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, -"Introductionto Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms",Pearson Education, Reprint 2006.
3. Harsh Bhasin, - "Algorithms Design and Analysis", Oxford university press, 2016.
4. S. Sridhar, - "Design and Analysis of Algorithms", Oxford university press, 2014.

COURSE OUTCOMES:

At the end of the course, the students should be able to:

- Design algorithms for various computing problems
- Analyze the time and space complexity of algorithms
- Critically analyze the different algorithm design techniques for a given problem
- Find optimal solution by applying various methods
- Modify existing algorithms to improve efficiency
- Compare between different data structures. Pick an appropriate data structure for a design situation

Elective Course - I- E-TECHNOLOGY

OBJECTIVES:

- Understand concept of Ecommerce and its types
- Be familiarized with technologies for Ecommerce
- Understand different types of Online Payment systems
- Understand Selling and marketing on web
- Be familiarized with concept of E-business and E-business Models
- Understand various E-business Strategies

UNIT-I

The Second wave of Global E-Business: introduction-Electronic Commerce- Business Model, Revenue Models, and Business processes-Advantages and disadvantages of Electronic Commerce- Economic Force And Electronic Commerce-Identifying Electronic Commerce opportunities International Nature of Electronic commerce. **Internet Concept**: Fundamental of web, History of web, web development overview, Domain Name System (DNS),DHCP and SMTP and other servers, internet service provider(ISP), Concept of IP Address, Internet Protocol, TCP/IP Architecture and protocol (IP), Web Browser and Web Servers.

UNIT-II

Business models: History of Business Models –internet of Starting up-lean Startups. Moving to manufacture: Designing Kits-E-certification-costs-Scaling up Software. Ethics-Privacy-control-Environment-Solutions. **E-Business Revenue Models**: Introduction –Revenue Models-Creating an effective Web presence Selling to Consumer online. Selling to **Consumer Online** : Introduction- Web marketing Strategies. **Selling to Business Online**: Introduction –Electronic Data Interchange.

UNIT-III

Active Server Page: Introduction(IIS), ASP object, Server object File system Object, session, accessing database with an ASP page, ODBC- ADO connection object, Common Methods and properties, ADO record set object. **Virtual Communities**: From Virtual Communities to social networks-mobile Commerce-Online Auctions. **E-Business Law and Taxation**: The Legal Environment of E-Commerce Ethics Issues – Taxation and E-commerce.

UNIT-IV

Online Security: Issues overview –security for client and server computers. **Online Payment system**: basics –payments cards Electronics cash –Electronic wallets. **E-Marketing**: traditional Marketing – Identifying Web Presence Goals-The Browsing Behavior Model-Online Marketing –E-Advertising-Internet marketing Trends-Target Markets-E-Branding –Marketing Strategies-E-Security .

UNIT-V

E-Strategy: Information and Strategy- The Virtual Value Chain – Seven Dimensions of E-Commerce Strategy-Value Chain and E-Strategy-Planning the E-Commerce Project –E-Commerce Strategy and Knowledge Management –E-Business Strategy and Data Warehousing and Data mining.**Mobile Commerce**: Wireless Applications - Technologies for Mobile commerce-WAP programming Model-Wireless Technologies-Different Generations in Wireless Communications-Security issues.

REFERENCE BOOKS

1. Gary P.Schneider, "E-Commerce Strategy, Technology and Implementations," Cengage Learning INDIA private Limited,.Reprint2008.

2. T.Joseph, "E-Commerce an Indian Perspective," 3rd Edition Prentice Hall of India.

3. N.P.Gopalan, J.Akilandeswari, "Web Technology:A developers Perpective", Second Edition, PHP Publications,2014.

4. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things" , Wiley,2014.

COURSE OUTCOMES:

- Define and differentiate various types of Ecommerce
- Describe Hardware and Software Technologies for Ecommerce
- Explain payment systems for E - commerce
- Describe the process of Selling and Marketing on web
- Define and Describe E-business and its Models
- Discuss various E-business Strategies

Elective – II – ARTIFICIAL INTELLIGENCE

OBJECTIVES:

- To develop a structured and detailed unified science of human and computational intelligence

- To know the various methods of knowledge representation

- To understand the basics of Natural Language processing and Expert System

UNIT - I

Introduction: Artificial Intelligence Definition – Importance of Artificial Intelligence – Knowledge Representation – State Space Search – Production Systems – Artificial Intelligence Programming Language – Prolog – Heuristic Search – Depth First – Breadth First – Hill Climbing.

UNIT – II

Knowledge Representation: Prepositional Logic – Clause Form – Predicate Logic – Resolution – Inference Rules – Unification – Semantic Networks – Frames – Conceptual Dependency.

UNIT – III

Symbolic Reasoning and Uncertainty: Non Monotonic Reasoning – Truth Maintenance Systems – Closed World Assumption – Modal and Temporal Logics – Bayes Theorem.
UNIT - IV

Natural Language Processing and Distributed Artificial Intelligence: Overview of Linguistics – Grammars and Languages – Basic Parsing Techniques – Semantic Analysis and Representation Structures – Natural Language Generation.

UNIT – V

Expert Systems: Architecture – Non Production Systems Architectures – Knowledge Acquisition and Validation – Knowledge System Building Tools – Types of Learning – General Learning Model.

TEXT BOOKS

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 2003.

2. Padhy N P, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2005

REFERENCE BOOKS

1. Stuart Russel and Peter Norvig, "Artificial Intelligence – A Modern Approach", Prentice Hall of India, 2003.

2. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, 2000.

3. Luger George F and A Stubblefield William, "Artificial Intelligence : Structures and Strategies for Complex Problem Solving ", Pearson Education , 2002

COURSE OUTCOMES:

After completing this course the student will be able to

- Understand the computation intelligence

- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning

Elective – II – THEORY OF COMPUTATION

OBJECTIVES:

- Understand various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine

- Be aware of Decidability and Un-decidability of various problems

UNIT – I

Finite State Automata: Introduction - Finite State Machine – Deterministic Finite Automata - Transition System – Nondeterministic Finite Automata – Difference between DFA and NFA – Equivalence of DFA and NFA - Finite Automata with Epsilon moves - Two-way Finite Automata - Finite Automata with Outputs.

UNIT – II

Grammar and Chomsky Classification: Introduction **-** Grammar – Chomsky Classification - Languages and their Relation. **Regular Languages and Expressions:** Introduction - Regular Languages – Regular Expressions – Finite Automata and Regular Expressions – Pumping Lemma – Regular Sets and Regular Grammar - Equivalence of Two Finite Automata.

UNIT – III

Context-Free Languages: Introduction - Context-Free Grammar – Context-free languages – Simplification of Context-free grammars. **Pushdown Automata**: Introduction - Pushdown Automata - Working Principle of Pushdown Automata – Auxiliary Pushdown Automata - Two-stack Pushdown Automata.

UNIT – IV

Turing Machine: Introduction - Turing Machine Model – Turing Machine – Representation of Turing Machine –Acceptance of Language by Turing Machine - Design of Turing Machines - Two-stack Pushdown Automata and Turing Machine - Variations of Turing Machine - Universal Turing Machine - Halting problem og Turing Machine - Linear-bounded Automata - Post Machine.

UNIT – V

Computability and Undecidability: Introduction - Unsolvable Problems – Computability - Mapping Reducibility - Decidability of Logical Theories - Turing Reducibility. **NP-Completeness:** Introduction - Measuring Complexity - The Class P – The Class NP - NP-Complete Problems.

TEXT BOOK

1. D.P.Acharjya, "Theory of Computation", MJP Publishers, 2010.

REFERENCE BOOKS

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2007.

2. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.

3. Thomas A. Sudkamp, "An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education, 2007.

COURSE OUTCOMES:

- Explain the models of computation, including formal languages, grammars and automata, and their connections

- Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars

Elective – II – MACHINE LEARNING

OBJECTIVES:

- To Learn about Machine Intelligence and Machine Learning applications

- To implement and apply machine learning algorithms to real-world applications

- To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems

- To understand how to perform evaluation of learning algorithms and model selection

UNIT – I

Introduction: Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT - II

Neural Networks and Genetic Algorithms : Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT - III

Bayesian and Computational Learning : Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT - IV

Instant Based Learning : K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT - V

Advanced Learning : Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

TEXT BOOK

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013

REFERENCE BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press , 2004.

2. Stephen Marsland, " Machine Learning An Algorithmic Perspective", CRC Press, 2009.

3. Michael Affenzeller, Stephan Winkler, Stefan Wagner, Andreas Beham, "Genetic Algorithms and Genetic Programming", CRC Press Taylor and Francis Group.

COURSE OUTCOMES:

- Remember the fundamental issues and challenges of machine learning: data, model selection, model complexity

- Have an understanding of the strengths and weaknesses of many popular machine learning approaches

- Analyze mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning

- Design the various machine learning algorithms

- Implement various machine learning algorithms in a range of real-world applications

Elective – II – WEB SERVICES

OBJECTIVES:

- To provide students with conceptual knowledge and skills required to develop web applications and web services
- To understand the evolution and emergence of web services
- To know about the fundamentals of soap and web services
- To understand the overview of Web Services Interoperability

UNIT - I

Evolution and Emergence of Web Services: Evolution of distributed computing - Core distributed computing technologies - client/server – CORBA - JAVA RMI - Micro Soft DCOM – MOM - Challenges in Distributed Computing - role of J2EE and XML in distributed computing - emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services: The definition of web service -, basic operational model of web services - tools and technologies enabling web services - benefits and challenges of using web services. Web Services Architecture: Web services Architecture and its characteristics - core building blocks of web services - standards and technologies available for implementing web services - web services communication - basic steps of implementing web services.

UNIT - II

Fundamentals of SOAP: SOAP Message Structure - SOAP Encoding - Encoding of different data types - SOAP message exchange models - SOAP communication and messaging - Java and Axis - Limitations SOAP. Describing Web Services: WSDL -WSDL in the world of Web Services - Web Services life cycle - anatomy of WSDL definition document - WSDL bindings - WSDL Tools - limitations of WSDL.

UNIT- III

Discovering Web Services: Service discovery - role of service discovery in a SOA - service discovery mechanisms - UDDI: UDDI Registries -uses of UDDI Registry - Programming with UDDI - UDDI data structures - Publishing API - Publishing information to a UDDI Registry - searching information in a UDDI Registry - limitations of UDDI.

UNIT - IV

Web Services Interoperability: Means of ensuring Interoperability - Overview of .NET - Creating a NET Client for an Axis Web Services - Creating Java Client for a web service - Challenges in Web Services Interoperability.

UNIT - V

XML SECURITY: Security Overview – Canonicalization – XML Security Framework – XML Encryption – XML Digital Signature – XKMS Structure – Guidelines for Signing XML Documents – XML in Practice.

TEXT BOOKS

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India, rp 2008.

2. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education, 2008.

3. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.

REFERENCE BOOKS

1. Building Web Services with Java, Second Edition, S. Graham and others, Pearson Edn., 2008.

2. Java web services, D.A. Chappell and T.Jewell, O'Reilly,SPD

3. Ron Schmalzer, Travis Vandersypen, Jason Bloomberg, "XML and Web Services Unleashed", 2nd Edition, Pearson Education, 2008

COURSE OUTCOMES:

On completion of the course, student will be able to:

- Define what is a web service

- Describe the formats for requests to and response from a web service that uses a SOAP interface

- Identify and describe the responsibilities for the design patterns that are appropriate for the design of a system using a web

Elective – III – CLOUD COMPUTING

OBJECTIVES:

- To provide students with basics of cloud computing concepts, technologies and architecture
- To understand the applications and implementations

UNIT - I

Computing Basics: Cloud computing definition - Characteristics- Benefit - Challenges - Distributed Systems - Virtualization-Service - oriented computing - Utility-oriented computing - Building Cloud Computing environments - computing platforms & technologies - Cloud Models – Cloud Service Examples - Cloud Based Services & Applications - Cloud concepts and Technologies.

UNIT - II

Virtualization, Cloud Services and Platforms: Virtualization - Characteristics - taxonomy-types - Pros and Cons - Examples Architecture: Reference model - types of clouds - Compute Service - Storage Services - Cloud Database Services - Application Services - Content Delivery Services - Analytics Services - Deployment and Management Service - Identity And Access Management Services - Open Source Private Cloud Software.

UNIT - III

Cloud Application Design and Development: Design consideration - Reference Architecture for Cloud Application - Cloud Application Design Methodologies - Data Storage Approaches-Development in Python: Design Approaches – Application: Image Processing - Document Storage - Map Reduce - Social Media Analytics.

UNIT - IV

Python for Cloud: Introduction - Installing Python- Data types & Data Structures- Control Flow - Functions- Modules- Packages - File Handling - Date/Time Operations – Classes- Python for Cloud: Amazon Web Services – Google Cloud Platform - Windows Azure –Map Reduced – Packages of Interest – Designing a Restful Web API.

UNIT - V

Big Data Analytics, Multimedia Cloud & Cloud Security: Big Data Analytics: Clustering Big data - Classification of Big Data – Recommendation systems. Multimedia Cloud: Case Study: Live Video Stream App - Streaming Protocols – Case Study: Video Transcoding App-Cloud Security: CSA Cloud Security Architecture - Authentication - Authorization - Identity and Access management - Data Security - Key Management - Auditing- Cloud for Industry, Healthcare & Education.

TEXT BOOKS

1. Buyya, Vecciola and Selvi, "Mastering Cloud Computing: Foundations and Applications Programming", Tata McGraw Hill, 2013.

2. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing A Hands – On Approach", Universities press (India) Pvt. limit., 2016.

REFERENCE BOOKS

1. Rittinghouse and Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2016.

2. Michael Miller, "Cloud Computing Web based application that change the way you work and collaborate online", Pearson Education, 2008.

3. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Jones & Bartlett Learning, 2012.

COURSE OUTCOMES:

- Remember the Cloud Computing environments & computing platforms
- Understand the Cloud data Services
- Analyze Cloud Application Design and Development
- Apply the Python data Types and Structures
- Remember and understand the Big Data Analytics and key Management

Elective – III – EMBEDDED SYSTEMS

OBJECTIVES:

- To understand about Embedded processor Modeling , Bus Communication in processors, Input/output interfacing

- To know about processor scheduling algorithms, and Real time operating system

UNIT - I

Introduction to Embedded System: Embedded Systems – Processor Embedded into a System – Embedded Hardware Units and devices in a system – Embedded Software in a System – Examples of Embedded Systems.

UNIT - II

Advanced Processor Architecture and Memory Organization: Introduction to advanced Architectures – Processor and Memory organization. **Devices and Communication Buses for Device Networks:** I/O Types and Examples – Timer and Counting Devices – Serial bus Communication and Parallel bus Communication protocols. **Device Drivers and Interrupts Service Mechanism:** ISR concept – Interrupt Servicing (Handling) Mechanism – Context and the periods for context switching, Interrupt Latency and Deadline- Direct Memory Access – Device driver programming.

UNIT - III

Programming Concepts and Embedded Programming in C and C++ and Java: Software Programming in Assembly Language (ALP) and in High Level Language 'C' – Embedded Programming in C++ - Embedded Programming in Java – **Inter-Process Communication and Synchronization of Processes, Threads and Tasks:** Multiple Processes in an Application - Multiple Threads in an Application– Tasks- Shared Data - Inter Process Communication.

UNIT - IV

Real Time Operating Systems: Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls- - RTOS Task Scheduling Models, Interrupt Latency and Response Time of the Tasks as Performance Metrics - OS Security Issues-**RTOS Programming I:** Basic functions and types of RTOS . **RTOS Programming II:** Linux 2.6.x and RTLinux.

UNIT - V

Design Examples and Case study: Case Study of an Embedded System for a Smart Card. **Embedded Software Development Process and Tools:** Introduction to Embedded Software Development Process and Tools – Host and Target Machines - Linking and Locating Software - Getting Embedded Software into the Target System - Issues in Hardware - Software Design and Co-design.

TEXT BOOK

1. Raj Kamal, "Embedded Systems – Architecture, Programming and Design", 2nd Edition, Tata McGraw-Hill, , 2008

REFERENCE BOOKS

1. David E. Simson, "An Embedded Software Primer," Addisons-Wesley, 2001.

2. Steve Heath, Embedded Systems Design, Elsevier, 2003.
3. Frank Vahid and Tony Givargis, "Embedded System Design," John Wiley And Sons, Inc, 2002.

COURSE OUTCOMES:

- Acquire knowledge about **devices** and buses used in **embedded** networking.
- Develop programming skills in **embedded systems** for various applications.
- Acquire knowledge about basic concepts of circuit emulators.
- Acquire knowledge about Life cycle of **embedded** design and its testing.

<div align="center">**Elective – III – SOCIAL COMPUTING**</div>

OBJECTIVES:
- Understand the important features of social computing
- Learn to analyze the data left behind in social media

UNIT - I

Mining Twitter: twitter in all the rage – Exploring Twitter's API, Analyzing the 140 characters. **Mining Facebook**: Exploring Facebook's social Graph API – Analyzing social graph connections. **Mining Google+:** Exploring the Google+ API. **Mining web pages**: Scraping, Parsing and crawling the Web.

UNIT - II

Analyzing the social web: Nodes, Edges and Network Measures, Basics of network structure, Representing networks, Basic Network structures and properties– Network Structure and Measures, Describing nodes and edges, Describing networks. Entity Resolution and Link Prediction.

UNIT - III

Community Maintained Resources, Supporting technologies for community maintained resources, User motivations-Location based social interaction , location technology, mobile location sharing- Social Information Sharing and social filtering, Automated recommender system – Social Media in the public sector, Analyzing public sector social media.

UNIT - IV

Random walks in social networks and their applications a survey: Random walks on Graphs : Background – **Related work**: Algorithms , Applications , Evaluation and datasets. **A survey of link prediction in social networks**: Feature based link prediction, Bayesian probabilistic models. **Privacy in social networks**: Privacy breaches in social networks.

UNIT - V

Visualizing social networks: A Taxonomy of visualizations – The convergence of Visualization, Interaction and Analytics. Data mining in social media – Text mining in social networks – Integrating sensors and social networks – Multimedia information networks.

TEXT BOOK

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, Linkedin, Google+, Github, and More," 2nd Edition, O'Reilly Media, 2013.

2. Jennifer Golbeck, "Analyzing the social web," Morgan Kaufmann, 2013.

3. Charu Aggarwal (ed.), "Social Network Data Analytics," Springer, 2011.

REFERENCE BOOKS

1. Tina Yesayan, "Social Networking: A Guide to Strengthening Civil Society Through Social Media(SMGuide4CSO)," U S Agency for International Development, 2014.

2. Subhasish Dasgupta, "Social Computing: Concepts, Methodologies, Tools, and Applications," Information Science Reference, Hershey, New York, 2010.

3. Todd Kelsey, "Social Networking Spaces: From Facebook to Twitter and Everything in Between," Apress the experts voice, 2010.

4. Parongama Sen, Bikas K. Chakrabarti, "Sociophysics: An Introduction, "Oxford University press, 2014.

5. Liu, Huan, Salerno, John, Young, Michael J. (Eds.), "Social Computing, Behavioral Modeling, and Prediction," Springer, 2008.

6. Davina Rungen, "Web 2.0 and Social Computing," Lambert Academic Publishing, 2011.

COURSE OUTCOMES:
- Understand the range of social computing applications and concepts.
- Understand and apply concepts of computational models underlying social computing
- Carry out simple forms of social analytics, involving network and language models, applying existing analytic tools on social information.
- Design and launch social computing applications.
- Understand the broad aspects of, and implement, richer social computing models in social computing applications.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principle

Elective – III – VIRTUAL REALITY

OBJECTIVES:

- To understand Geometric modeling and Virtual environment
- To study about Virtual Hardwares and Softwares
- To develop Virtual Reality applications

UNIT–I

Introduction to Virtual Reality: Virtual Reality & Virtual Environment: Introduction – Computer graphics – Real time computer graphics – Flight Simulation – Virtual environments – requirement – benefits of virtual reality – Historical development of VR: Introduction – Scientific Landmark – 3D Computer Graphics: Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Colour theory – Simple 3D modeling – Illumination models – Reflection models – Shading algorithms – Radiosity – Hidden Surface Removal – Realism –Stereographic image.

UNIT–II

Geometric Modeling: Geometric Modeling: Introduction – From 2D to 3D – 3Ds pace curves – 3D boundary representation – Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances – Picking – Flying – Scaling the VE – Collision detection – A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction – VR Systems.

UNIT–III

Virtual Environment: Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation – The animation of objects – linear and nonlinear translation – shape & object inbetweening – free from deformation – particle system – Physical Simulation: Introduction – Objects falling in a gravitational field – Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.

UNIT–IV

VR Hardwares & Softwares: Human factors: Introduction – the eye-the ear-the somatic senses – VR Hardware: Introduction – sensor hardware – Head-coupled displays – Acoustic hardware – Integrated VR systems – VR Software: Introduction – Modeling virtual world – Physical simulation –VR toolkits – Introduction to VRML.

UNIT–V

VR Applications: Virtual Reality Applications: Introduction – Engineering –Entertainment – Science – Training – The Future: Introduction – Virtual environments – Modes of interaction.

TEXT BOOK

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.

REFERENCE BOOKS

1. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.

2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006.

3. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann, 2008.

COURSE OUTCOMES:
- Remember the virtual reality Concepts
- Have an understanding of the Virtual environment
- Implement Virtual Hardware and software
- Design Virtual Reality toolkits
- Able to develop Virtual Reality applications

Elective – IV – CYBER SECURITY

OBJECTIVES:

- To highlight the importance of Cyber Security, Security principles, Cyber Security Challenges and Ethical Practices
- To classify cyber-attacks, present different vulnerability weaknesses, Intrusions and the methods to handle them
- To introduce the learners the fundamentals in the upcoming technologies, forensic investigations, precautions against different frauds and scams and legal implications

UNIT – I

Introduction to Cyber Space - Introduction to Information Systems - Need for Cyber Security - Introduction to Cyber Attacks - Classification of Cyber Attacks - Classification of Malware, Threats - Vulnerability Assessment – **(Intrusion Detection Systems - Intrusion Prevention Systems)*.**

UNIT – II

Introduction to User Authentication Methods - Biometric Authentication Methods - Biometric Systems - Different Security Models and Security Mechanisms - Information Security and Network Security - Operating System Security - Web Security - Email Security – **(Mobile Device Security)***, Cloud Security.

UNIT – III

IoT Security - Cyber Physical System Security - Social Media Security – **(Virtual Currency - Block Chain Technology - Security Auditing)*** - Cyber Crimes - Different Types of Cyber Crimes, Scams and Frauds.

UNIT – IV

Analysis of Crimes, Human Behavior - Stylometry, Incident Handling - Investigation Methods - Criminal Profiling, Cyber Trails - Digital Forensics, History, Challenges - Branches of Digital Forensics. Digital Forensic Investigation Methods – **(Reporting, Management of Evidence)***

UNIT – V

Cyber Law-Basics - Information Technology Act 2000 - Amendments to IT Act 2000 - Evidentiary value of Email/SMS, Cybercrimes and Offenses dealt with IPC - RBI Act and IPR Act in India - Jurisdiction of Cyber Crime, **(Cyber Security Awareness Tips)*.**

* Indicates Self-study components

E-BOOKS

1. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf

2. http://larose.staff.ub.ac.id\files/2011/12/Cyber-Ciminology-Exploring-Iternet-Crimes-and-Criminal-Behavior.pdf

3. http://larose.staff.ub.ac.id\files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-

4. http://docshare04.docshare.tips/files/21900/219006870.pdf

5. http://www.uou.ac.in/sites/default/files/slm/FCS.pdf

6. https://cyber-cops.com/book_detail

REFERENCE BOOKS

1. Charles J. Brooks, Christopher Grow, Philip Craig Donald Short, "Cybersecurity Essentials", (2018), John wiley and sons.
2. Lester Evans, "Cyber security: An Essential Guide to Computer and Cyber Security for Beginners, Including Ethical Hacking, Risk Assessment, Social Engineering, Attack and Defense Strategies, and Cyber warfare", John Wiley and Sons.
3. Prof. AmitGarg Dr.Krishnan Kumar Goyal, " Cyber security", 2019, Laxmi publications

ONLINE RESOURCES / TUTORIALS

1. https://onlinecourses.swayam2.ac.in/cec21_cs09/preview

2. https://onlinecourses.swayam2.ac.in/nou21_cs01/preview

3. https://innovationatwork.ieee.org/cyber-security/

4. https://www.sans.org/security-resources/

5. https://online.stanford.edu/professional-education/cybersecurity

6. https://www.nist.gov/itl/applied-cybersecurity/nice/resources/online-learning-content

COURSE OUTCOMES:

- Outline the security rudiments, comprehend the Cyber Security challenges and discriminate between different Intrusion handling Methods

- Judge and evaluate different biometrics and suggest suitable ones. Analyze the different types of security models, Audit and Assessment processes

- Assess different security types and practice appropriate security mechanisms to minimize the risks

- Justify the importance of cybercrime investigation in detecting frauds and scams, scrutinize various steps and methods involved in the investigation process and prepare appropriate reports

Elective – IV – DATA VISUALIZATION

OBJECTIVES:

- To understand the significance of data and to communicate this information clearly and efficiently
- To understand the visual representations of data and visualization techniques

UNIT - I

Introduction: Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

UNIT - II

Creating visual representations - visualization reference model - visual mapping - visual analytics - Design of visualization applications - Classification of visualization systems

UNIT - III

Visualization Techniques - Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data : Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data : Point-Based Techniques - Line Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks .

UNIT - IV

 Visualization of groups - trees - graphs - clusters - networks - software - Metaphorical visualization

UNIT - V

Security Data Visualization - Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems - Creating security visualization system.

TEXT BOOK

1. Scott Murray, "Interactive data visualization for the web", O"Reilly Media, Inc., 2013.

2. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010

3. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", No Starch Press Inc, 2007.

REFERENCE BOOK

1. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008

2. Ben Fry, "Visualizing Data", O"Reilly Media, Inc., 2007

COURSE OUTCOMES:

On completion of the course, student will be able to:

- Understand better analysis, quick action, identifying patterns and grasping the latest Trends
- Understand the more specific methods to visualize data

Elective – IV – DEEP LEARNING

OBJECTIVES:

- To understand the evolution of deep architectures

- To apply deep learning principles to Natural Language Processing

- To assess the challenges of multimodality and reinforcement learning

UNIT -I

Deep Learning: AI and deep learning - The history and rise of deep learning - Why Deep Learning? - The motivation of deep architecture – Applications - Future potential and challenges. Getting Yourself Ready for Deep Learning: Basics of linear algebra - Deep learning with GPU - Deep learning software frameworks - Setting up deep learning on AWS

UNIT -II

Getting Started with Neural Networks: Multilayer perceptrons - How a network learns - Deep learning models - Practical examples. Deep Learning in Computer Vision: Origins of CNNs- Convolutional Neural Networks -Fine-tuning CNNs - Popular CNN architectures

UNIT –III

NLP - Vector Representation: Traditional NLP - Deep learning NLP – Applications. Advanced Natural Language Processing: Deep learning for text - Recurrent neural networks - Long short-term memory network – Applications

UNIT –IV

Multimodality: What is multimodality learning? - Challenges of multimodality learning-Image captioning - Visual question answering - Multi-source based self-driving. Deep Reinforcement Learning: What is reinforcement learning (RL)? - Deep reinforcement learning - Implementing reinforcement learning

UNIT – V

Deep Learning Hacks: Massaging your data - Tricks in training - Fine-tuning - Model compression. Deep Learning Trends: Recent models for deep learning - Novel applications

TEXT BOOK

1. Anurag Bhardwaj, Wei Di, JianingWei,"**Deep Learning Essentials**", Packt Publishing, 2018. Chapters:1-10

REFERENCE BOOK

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

2. Bishop, C.M., Pattern Recognition and Machine Learning, Springer, 2006.

COURSE OUTCOMES:

- To understand the fundamentals of **deep learning**.
- To know the main techniques in **deep learning** and the main research in this field.
- Applying knowledge and understanding.
- Be able to design and implement **deep neural network** systems.

Elective – IV – GRID COMPUTING

OBJECTIVES:

- To understand how grid computing helps in solving large scale scientific problems

- To learn program concepts of grid and cloud

- Understand the security issues in grid and cloud environment

UNIT – I

Introduction to Grid Computing: Grid Computing Concept, History of Distributed Computing Computational Grid Applications, Grid Computing Infrastructure Development, Grid Computing Software Interface. **Job Submission:** Introduction, Globus Job Submission, Transferring Files.

UNIT – II

Schedulers: Scheduler Features, Scheduler Examples, Grid Computing Meta-Schedule Distributed Resource Management Application (DRMAA).

UNIT – III

Security Concepts: Introduction, Symmetric Key Cryptography, Asymmetric KeyCryptography (Public Key Cryptography), Public Key Infrastructure. Systems / Protocols using Security Mechanisms. **Grid Security:** Introduction, Grid Security Infrastructure (GSI).Delegation, Higher Level Authorization Tools.

UNIT – IV

System Infrastructure I: Web Services: Service-Oriented Architecture, Web Services and Service Implementation. **System Infrastructure II:** Grid Computing Services: Grid Computing and Standardization Bodies Interacting Grid Computing Components, Open GridServices Architecture (OGSA), WSRF, User-Friendly Interfaces: Introduction Grid Computing Workflow Editors, Grid Portals.

UNIT – V

User-Friendly Interfaces: Introduction-Grid Computing Workflow Editors-Grid Portals. **Grid-Enabling Applications:** Introduction, Parameter Sweep, Using an Existing Program on Multiple Grid Computers, Writing an Application Specifically for a Grid, Using Multiple Grid Computers to Solve a Single Problem.

TEXT BOOK

1. Barry Wilkinson, "Grid Computing Techniques and Applications", CRC Press, 2010

REFERENCE BOOKS

1. Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing:Clusters,

2. Grids,Clouds and the Future of Internet", First Edition, Morgan KaufmanPublisher, an Imprint of Elsevier, 2012.

3. Frederic Magoules, Jie Pan, Kiat-An Tan, Abhinit Kumar, "Introduction to GridComputing", CRC Press, 2009.

COURSE OUTCOMES:

- Understanding the fundamentals of grid computing.
- Discussing the basics of grid monitoring
- Learning the concepts of grid security and resource management
- Understanding the concepts of grid portals
- Understanding the advanced grid middleware

EXTRA DISCIPLINARY PAPERS
COMPUTER SCIENCE

List of **Extra Disciplinary Courses** (Non-Major Electives) offered by the Department of Computer Science/Applications for other PG programmes

EDC – I - PRINCIPLES OF INFORMATION TECHNOLOGY

OBJECTIVES:

- To learn the basic concept and skills associated with information technology

- To know the Computer hardware and software technologies

- To gain the knowledge of organizing data

- To assess the current role of Information Science in an organization

- To understand how IT relates to organizational goals

UNIT-I

Business Environment: Business and Information technology – business in the information age– about information technology–what is an information system– Information Technology in the Modern Organization.

UNIT-II

Computer Hardware – Significance of Hardware – Central Processing Unit– Computer Memory – Computer Hierarchy – Input Technologies – Output Technologies. Computer Software: Software History and Significance–System Software–Application Software– Software issues–Programming languages–Enterprise Software.

UNIT-III

Managing Organizational Data and Information: Basics of Data arrangement and Access – Traditional file environment – modern approach: database management systems – logical data models – data warehouses – Networks– Internet- Evolution of the Internet –Operation of the Internet– WWW-Intranets and Extranets.

UNIT-IV

Functional, Enterprises, and Inter organizational Systems: Information system to support business functions – transaction processing information systems – accounting and finance system – marketing and sales system – production and operations management system – Integrated information system and enterprises resource planning–inter organizational/Global information system. –Electronic Commerce

UNIT-V

Information Systems Development: Information system planning–Traditional systems development life cycle – alternative methods for system development –system development outside the IS department – building Internet and Intranet applications –Implementing: Ethics, Impacts and Security.

TEXTBOOK

1. Turban, Rainer, Potter "Introduction to Information Technology," Second edition, Wiley India, 2007.

REFERENCE BOOK

1. V. Rajaraman, "Introduction to Information Technology, "Prentice Hall of India,2007

COURSE OUTCOMES:

- Able to understand the basics of information technology

- Gaining the knowledge of Hardware and Software technologies

- Learning the method of organizing data

- Assessing the role of Information Science to an organization.

- Understanding the role of IT in organizations

EDC – II - FUNDAMENTALS OF COMPUTERS AND COMMUNICATIONS

OBJECTIVES:

- To know the basics of Computers

- To learn the internal Components of Computers

- To understand the OS and its types

- To study the basics of networks and Internet

- To get a clear idea on DBMS and its concepts

UNIT-I

Introduction: What is computer – Components of Computers – Advantages and Disadvantages of using computers – Computer Software – Categories of Computers - Elements of information systems. The Components of the Systems Unit: Processor – Data representation – Memory – Mobile Computers and Devices.

UNIT–II

Input and Output Device: What is input – what are input devices – keyboard – pointing device – mouse – other pointing devices – Voice input –Digital Cameras – Video input – Scanners and Reading devices Terminals – Biometric input - Input devices for physically challenged users-Output: What is output – display devices – Monitors – Printers –Speakers, Headphones and Ear phones – output device for physically challenged users – Storage devices.

UNIT-III

Operating Systems and Utility Programs: System software – Operating system – Operating system functions – types of operating systems – standalone operating systems–network operating systems – embedded operating system. Application Software: Application software – Business software – Graphics and Multimedia Software–Application software for Communication.

UNIT-IV

Internet and World Wide Web: Internet – History of the Internet – How the Internet works – WWW–E-commerce–Communications and Networks: Communications – Uses of Computer Communications – Networks – Communication software – Communication devices – Communications Channel – Physical transmission media and Wireless transmission media.

UNIT-V

Database Management: Databases, Data and Information, The Hierarchy of data–Maintaining data – File processing versus databases – database management systems–relational, object oriented and multi dimensional databases – web databases – database administration. Computer Security: Computer security risks – Internet and network attacks –Unauthorized access and use.

TEXT BOOK

1. Gary B. Shelly, Thomasj. Cashman, Misty E.Vermaat, "Introduction to Computers,"Cengage Learning, 2008

REFERENCE BOOKS

1. Reema Thareja, "Fundamentals of Computers", Oxford Univ. Press,2015
2. Deborah Morley, Charles S.Parker, "Understanding Computers-Today and Tomorrow",14th Edition, Thomson Course Technology, 2012
3. Alexis Leon, Mathew's Leon, "Fundamentals of Computer Science and Communication Engineering", Vikas Publishing House, New Delhi, 1998.

COURSE OUTCOMES:

- Understanding the basics and internal parts of Computers

- Gaining the knowledge on OS and its types

- Studying the basics of networks and Internet

- Learning the databases and DBMS concepts

EDC - III - E-COMMERCE

OBJECTIVES:

- To know the mercantile and consumer process model

- To understand the Consumer's and Merchant's perspective

- To get an in depth idea on electronic data interchange

- To gain the knowledge on Internet, growth of internet and its commercial uses

UNIT-I

Electronic Commerce – Electronic Commerce Frame work – The Anatomy of Electronic Commerce Applications - Electronic Equipment Consumer Applications - Electronic Commerce Organization Applications - Components of I-Way – Network Access Equipment.

UNIT-II

Architecture Framework for Electronic Commerce- World Wide Web as the Architecture – Consumer Oriented Applications – Mercantile Process Models – Mercantile Models from the Consumer's Perspective and Merchant's Perspective.

UNIT-III

Electronic Payment Systems: Types of Electronic Payment Systems – Digital Token based Electronic Payment Systems–Smart Card and Credit Card Based Electronic Payment Systems – Risk and Electronic Payment Systems – Designing Electronic Payment Systems.

UNIT-IV

Electronic Data Interchange – EDI Applications in Business – EDI: Legal, Security and Privacy issues EDI and Electronic Commerce – Standardization and EDI – EDI Software Implementation.

UNIT–V

Internet and World Wide Web: origin of the Internet – New uses for the Internet – Commercial use of the Internet–Growth of the Internet – Advertising on the Internet.

TEXT BOOKS

1. Kalakota and Whinston, "Frontiers of Electronic Commerce", Pearson Education, 2004.

2. Gray P.Scheider, "Fourth Annual Edition Electronic Commerce", Thomson Course Technology, 2003.

REFERENCE BOOKS

1. Kamalesh K. Baja, Debjani Nag, "E-Commerce–The Cutting Edge of Business", TMH Publications, 2005.

2. Agarwala, K.N, Deeksha Agarwala, "Business on the Net: What's and How's of E-Commerce;" Macmillan, New Delhi.

3. Parag Diwan, Sunil Sharma, "Electronic Commerce: A Manager's Guide to E-Business", Excel books, 2005.

COURSE OUTCOMES:

- Learning the introduction on e-commerce

- Understanding the mercantile and consumer process models

- Analysing the consumers and merchant's perspective on e-commerce

- Getting an idea on Electronic Data Interchange

- Gaining the knowledge on Internet