SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)

Tamil Nadu, India

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DEGREE OF MASTER OF SCIENCE IN COMPUTER SCIENCE

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

M.Sc. COMPUTER SCIENCE PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2022-2023 Onwards)

Programme Outcomes (POs)

PO1	Understand the advanced concepts of key areas in Computer Science and enable students to expose technical, analytical and creative skills.
PO2	Understanding and applying knowledge of mathematics, science, algorithmic and computing skills to acquire solution of complex scientific problems.
PO3	Build the student's effective communication, ethical attitudes, team work and logical proficiency.
PO4	Students are to be imparted with a broad conceptual background in the Computing sciences to design, implement and evaluate a computational system.
PO5	Make use of modern IT tools and techniques to develop practical skills for fulfilling the needs of industry and society.
PO6	Develop research oriented skills to identify, analyse and synthesize scholarly literature relating to the field of Computer Science.

Programme Specific Outcomes (PSOs)

PSO1	Posses the knowledge in the field of Computer Science through theory and practicals.
PSO2	Students will demonstrate high-level expertise in computer Science research and in the synthesis of research.
PSO3	Communicate computer science concepts, designs, and solutions effectively and professionally.
PSO4	Use software development tools, software systems, and modern computing platforms.
PSO5	Design, correctly implement and document solutions to significant computational problems.

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Master of Science (M.Sc.) in Computer Science

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2022-2023 Onwards)

Sl. No	Nature of the Course	Course Code	Name of the Course	Hours/ Week	Credits	Marks		
						CIA	ESE	Total
SEMESTER I								
1	Core – I	21PCS1C01	Design and Analysis of Algorithms	4	4	25	75	100
2	Core – II	21PCS1C02	Advanced Web Technology	4	4	25	75	100
3	Core – III	21PCS1C03	Advanced Database Management Systems	4	4	25	75	100
4	Core – IV	21PCS1C04	Discrete Mathematics	4	4	25	75	100
5	Elective – I	----	Elective – I	4	4	25	75	100
6	Core Practical-I	21PCS1P01	Algorithms using C++ Lab	5	2	40	60	100
7	Core Practical-II	21PCS1P02	Advanced Web Technology Lab	5	2	40	60	100
Total				**Total**	**30**	**24**	**205**	**495**
SEMESTER II								
8	Core – V	21PCS2C05	Distributed Operating System	4	4	25	75	100
9	Core – VI	21PCS2C06	Advanced Java Programming	4	4	25	75	100
10	Core – VII	21PCS2C07	Cryptography and Network Security	4	4	25	75	100
11	Elective– II	----	Elective– II	4	4	25	75	100
12	Core Practical-III	21PCS2P03	Advanced Java Programming Lab	4	2	40	60	100
13	Core Practical-IV	21PCS2P04	DOS Lab	4	2	40	60	100

14	EDC	----	Extra Disciplinary Course (EDC) (Other than CS Major Subject)	4	4	25	75	100
15	Common Course	21P2HR01	Human Rights	2	2	25	75	100
Total				**30**	**26**	**230**	**570**	**800**
SEMESTER III								
16	Core – VIII	21PCS3C08	Digital Image Processing	4	4	25	75	100
17	Core – IX	21PCS3C09	Internet of Things	4	4	25	75	100
18	Core – X	21PCS3C10	Machine Learning	4	4	25	75	100
19	Core – XI	21PCS3C11	Data Analytics	4	4	25	75	100
20	Elective–III	----	Elective–III	4	4	25	75	100
21	Core Practical-V	21PCS3P05	Data Analytics Lab	5	2	40	60	100
22	Mini Project	21PCS3PR01	Mini Project	5	4	40	60	100
SWAYAM / MOOC / SOFT SKILL (Optional)				ADD ON COURSE				
Total				**30**	**26**	**205**	**495**	**700**
SEMESTER IV								
24	Elective-IV	----	Elective-IV	8	4	25	75	100
25	Elective-V	----	Elective-V	8	4	25	75	100
26	Project	21PCS4PR02	Dissertation and Viva-Voce (Industry/Research)	14	6	50	150	200
Total				**30**	**14**	**100**	**300**	**400**
Cumulative Total				**120**	**90**	**740**	**1860**	**2600**

Note

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

Major Electives

Elective Course – I

Semester	Paper	Course Code	Name of the Course
I	I	21PCS1E01	Software Project Management
	II	21PCS1E02	Wireless Networks
	III	21PCS1E03	Object Oriented System Development

Elective Course – II

Semester	Paper	Course Code	Name of the Course
II	I	21PCS2E04	Data Mining and Warehousing
	II	21PCS2E05	Compiler Design
	III	21PCS2E06	Embedded Systems

Elective Course – III

Semester	Paper	Course Code	Name of the Course
III	I	21PCS3E07	Bio-informatics
	II	21PCS3E08	Theory of Computation
	III	21PCS3E09	Cloud Computing

Elective Course – IV

Semester	Paper	Course Code	Name of the Course
IV	I	21PCS4E10	Mobile Computing
	II	21PCS4E11	Soft Computing
	III	21PCS4E12	Principles of Information Security

Elective Course – V

Semester	Paper	Course Code	Name of the Course
IV	I	21PCS4E13	Social Network Analysis
	II	21PCS4E14	Professional Ethics
	III	21PCS4E15	Block Chain Technology

EDC-EXTRA DISCIPLINARY COURSE

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

Semester	Course Code	Name of the Course
II	21PCS2EDC01	Principles of Information Technology
	21PCS2EDC02	Fundamentals of Computers and Communications
	21PCS2EDC03	E-Commerce

PROGRAMME SYLLABUS

Program: M.Sc Computer Science				
Core – I	**Course Code:** 21PCS1C01		**Course Title:** Design and Analysis of Algorithms	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

1. Undersatnd and Apply an algorithms and design techniques to solve problems.
2. Analyze the complexities of various problems in different domains.
3. Analyze the algorithmic performance of various algorithms to determine the computational complexity of algorithms.

UNIT – I

Introduction: Notion of Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Frame Work – Asymptotic Notations and Basic Efficiency Classes – Mathematical Analysis of Non-recursive Algorithms – Non-recursive Solution to the Matrix Multiplication – Mathematical Analysis of Recursive Algorithms – Recursive Solution to the Tower of Hanoi Puzzle- Visualization.

UNIT – II

Divide and Conquer: Merge sort – Quick sort – Binary Search – Binary Tree Traversals – Multiplication of Large Integers – Closest Pair and Convex Hull Problems – **Greedy Technique:** Container loading problem – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm.

UNIT – III

Dynamic Programming: Principle of optimality - Coin changing problem – Computing a Binomial Coefficient – Warshall's and Floyd's Algorithms – Warshall's Algorithm – Floyd's Algorithm for the All-Pairs Shortest-Paths Problem – Multi stage graph – Optimal Binary Search Trees – The Knapsack Problem and Memory Functions**.**

UNIT – IV

Backtracking: N-Queens Problem – Hamiltonian Circuit Problem – Subset Sum Problem – **Branch and Bound:** LIFO Search and FIFO search – Assignment Problem – Knapsack Problem – Travelling Salesman Problem.

UNIT - V

P, NP and NP-Complete Problems – Approximation Algorithms for NP-Hard Problems – Approximation Algorithms for the Travelling Salesman Problem – Approximation Algorithms for the Knapsack Problem.

Text Book

1. Anany Levitin, "Introduction to the Design and Anal ysis of Algorithms", Pearson Education, 2008.

Reference Books

1. S.K. Basu, "Design Methods and Analysis of Algorith ms", Prentice Hall, 2005.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, "Introduction to Algorithms", Prentice Hall 1990.
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
4. Donald E. Knuth, "The Art of Computer Programming", Volumes 1 & 3 Pearson Education, 2009.
5. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, Second Edition, Reprint 2009.

Web Resources

1. https://www.javatpoint.com/daa-tutorial
2. https://www.tutorialspoint.com
3. https://nptel.ac.in/courses/106/106/106106131
4. http://openclassroom.stanford.edu
5. https://www.geeksforgeeks.org/fundamentals-of-algorithms

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand fundamental algorithmic design concepts and techniques for computational problem solving.	K1 & K2
CO2	Apply an appropriate algorithm design techniques for solving problem.	K2 & K3
CO3	Ability to analyze the performance of algorithms by comparing the efficiency of algorithms with asymptotic complexity.	K4
CO4	Ability to design algorithms using standard paradigms like: Greedy, Divide and Conquer, Dynamic Programming Backtracking and branch and bound.	K5 & K6
CO5	Ability to understand P & NP class problems for formulating solutions using standard approaches.	K6

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

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	M
CO2	S	M	S	M	S	S
CO3	S	S	M	S	M	M
CO4	S	S	M	S	S	S
CO5	S	S	S	S	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – II	**Course Code:** 21PCS1C02		**Course Title:** Advanced Web Technology	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

1. Explore the backbone of web page creation by developing .NET skill.
2. Enrich knowledge about HTML control and web control classes
3. Provide depth knowledge about ADO.NET
4. Understand the need of usability, evaluation methods for web services
5. To promote the web designing skills and data handling capabilities

UNIT – I

OVERVIEW OF ASP.NET - The .NET Framework – Learning the .NET Languages : Data Types – Declaring Variables- Scope and Accessibility- Variable Operations- Object Based Manipulation- Conditional Structures- Loop Structures- Functions and Subroutines. Types, Objects and Namespaces : The Basics about Classes- Value Types and Reference Types- Advanced Class Programming- Understanding Name Spaces and Assemblies.

UNIT – II

Developing ASP.NET Applications - ASP.NET Applications: ASP.NET Applications – Code Behind - Understanding ASP.NET Classes - ASP.NET Configuration. Web Form Fundamentals: A Simple Page Applet - HTML Control Classes. Web Controls: Web Control Classes – Auto PostBack and Web Control Events- Accessing Web Controls. Using Visual Studio.NET: Starting a Visual Studio.NET Project - Writing Code - Visual Studio.NET Debugging - Validation and Rich Control: The Calendar control - formating Calendar - The AdRotator – Validation - Simple Validation Example - Understanding Regular Expression - State Management - View State - Session State – Application State.

UNIT – III

Working with Data - Overview of ADO.NET - ADO.NET and Data Management- Characteristics of ADO.NET-ADO.NET Object Model. ADO.NET Data Access : SQL

Basics– Select , Update, Insert, Delete Statements- Accessing Data- Creating a Connection- Using a Command with a DataReader - Accessing Disconnected Data - Updating Disconnected Data. Data Binding: Single Value Data Binding- Repeated Value Data Binding- Data Binding with Databases. Data List – Data Grid - Comparing Template Controls.Using XML: XML Explained- The XML Classes.

UNIT – IV

Web Services - Web Services Architecture : Internet Programming then and now - WSDL – SOAP - Communicating with a Web Service - Web Service Discovery and UDDI. Creating Web Services : Web Service Basics – Documenting the Web Service- Testing the Web Service - Web Service Data Types - ASP.NET Intrinsic Objects.

UNIT – V

Advanced ASP.NET - Component Based Programming: Creating a Simple Component – Database Components - Using COM Components. Custom Controls: User Controls - Deriving Custom Controls. Implementing Security: Determining Security Requirements - The ASP.NET Security Model - Forms Authentication- Windows Authentication.

Text Book

1. Mathew Mac Donald, “ASP.NET Complete Reference”, TMH 2005.

Reference Books

1. Crouch Matt J, “ASP.NET and VB.NET Web Programming”, Addison Wesley 2002.

2. J.Liberty, D.Hurwitz, “Programming ASP.NET”, Third Edition, O’REILLY, 2006

Web Resources

1. https://www.tutorialspoint.com/asp.net/asp.net_introduction.htm
2. https://www.geeksforgeeks.org/introduction-to-asp-net/
3. https://www.guru99.com/what-is-asp-dot-net.html
4. https://docs.microsoft.com/en-us/dotnet/framework/develop-web-apps-with-aspnet
5. https://www.w3schools.com/asp/ado_intro.asp

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understanding basic concept of Web Technology.	**K1, K2**
CO2	Recognize an importance of validation control, cookies and session.	**K3& K4**
CO3	Applying the knowledge of ASP.NET object, ADO.NET data access and SQL to develop a client server model.	**K4, K5, K6**
CCC	Recognize the difference between Data list and Data grid controls in accessing data	**K4**
CO5	Enable to create a simple component and Database components in ASP.Net.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO NUMBER	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	S	S
CO2	S	M	M	S	M	S
CO3	S	S	S	S	S	M
CO4	S	S	M	M	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – III	**Course Code:** 21PCS1C03		**Course Title:** Advanced Database Management Systems	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

1. To understand and apply the principles of Relational model and SQL.
2. To understand the use of E-R model and Normalization.
3. To understand the concept of parallel, distributed and object based databases.
4. To know the concept of Spatial, Temporal databases and advanced transaction processing.

UNIT – I

Introduction to the Relational Model and SQL: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations. **Introduction to SQL**: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

UNIT – II

Intermediate SQL: Join Expressions, Views. - Database Design and E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams. **Database-System Architectures:** Centralized and Client–Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types.

UNIT – III

Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism. **Distributed Databases**: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing.

UNIT – IV

Object-Based Databases: Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Object Oriented versus Object Relational. **XML**: Structure of XML Data, XML Document Schema, Querying and Transformation, API to XML, Storage of XML Data, XML Applications.

UNIT – V

Spatial and Temporal Data: Time in Databases, Spatial and Geographic Data, Multimedia Databases. **Advanced Transaction Processing**: Transaction-Processing Monitors, Transactional Workflows, Real-Time Transaction Systems, Long-Duration Transactions.

Text Books

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, “Database System Concepts”, 6th edition , McGraw-Hill International Edition , 2013.

Reference Books

1. Ramez Elmasri, Shamkant B Navathe, “Fundamental of Database Systems”, Pearson, 7th edition 2016.
2. Thomas Connolly, Carolyn Begg., “Database Systems a practical approach to Design , implementation and Management “, Pearson Education, 2014.

Web Resources

1. http://www.exploredatabase.com/p/blog-page.html
2. https://www.tutorialspoint.com/dbms/index.htm
3. https://www.quora.com/
4. https://en.wikipedia.org/wiki/XML_database

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Know about relational model and SQL.	**K1, K2**
CO2	Understand the basic concepts of E-R model, relational database and normalization.	**K3& K4**
CO3	Learn parallel, distributed and Object Oriented Databases	**K4, K5, K6**
CO4	Student will be proficient in XML database	**K4**
CO5	Students will understand the concept of Spatial, Temporal databases and transaction processing.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	S	S
CO2	S	M	S	S	S	M
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	M
CO5	S	M	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – IV	**Course Code:** 21PCS1C04		**Course Title:** Discrete Mathematics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

To extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

UNIT – I

Mathematical Logic Connectives: Negation – Conjunction – Disjunction – Statement Formulas and Truth Table – Conditional and Bi-conditional – Well-Formed Formulas-Tautologies-Examples Only. (Chapter 1: Sections 1.2.1 to 1.2.4, 1.2.6 to 1.2.8, Page No: 7-14 & 18-26).

UNIT – II

Mathematical Logic (Continued) Normal Forms: Disjunctive Normal Forms – Conjunctive Normal Forms – Principal Disjunctive Normal Forms – Principal Conjunctive Normal Forms-Examples Only. (Chapter 1: Sections 1.3.1 to 1.3.4, Page No: 50-58).

The Theory of Inference for the Statement Calculus: Validity using Truth Tables – Rules of Inference – Consistency of Premises and Indirect Method of Proof-Examples Only. (Chapter 1: Sections 1.4.1 to 1.4.3, Page No: 65-73).

UNIT – III

Set Theory Relations and Ordering: Relations–Properties of Binary Relation in a Set. **Functions:** Definition and Introduction – Composition of Functions – Inverse Functions. **Natural Numbers:** Peano Axioms and Mathematical Induction-Examples Only. (Chapter 2: Sections 2.3.1-2.3.2 and 2.4.1-2.4.3 and 2.5.1, Page No: 148-155, 192-203 and 220-224).

UNIT – IV

Lattices and Boolean Algebra Lattices as Partially Ordered Sets: Definition and Examples – Some Properties of Lattices- Boolean Algebra-Definition and Example – Sub Algebra, Direct Product and Homomorphism – Boolean Functions – Boolean Forms and Free Boolean Algebra – Values of Boolean Expression and Boolean Functions-Examples Only. (Chapter 4: Sections 4.1.1-4.1.2, 4.2.1-4.2.2 and 4.3.2, Page No: 378-384, 397-403 and 406-416)

UNIT – V

Graph Theory Introduction-Basic Definitions-Degree of a Vertex-Some Special Simple Graphs-Connectedness in Directed Graphs-Shortest Path Algorithm-Spanning Trees-Minimum Spanning Trees-Prim's Algorithm-Kruskal's Algorithm-Example 7.2, 7.3, 7.4, and 7.5 only. (Chapter 7, Page No: 366-371, 393-398, 416-417 and 422-425)

Text Books

1. J.P. Trembly, R. Manohar, Discrete Mathematical Structure with Applications to Computer Science, Tata McGraw Hill Publishing Private Limited, New Delhi, 2001. (For Unit I, II, III, IV-All the Chapters example problems only, but exercise are not excluded.)
2. T. Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill Education Private Limited, New Delhi, 2010. (For Unit V).

Reference Books

1. Prof. V. Sundaresan, K. S. Ganapathy Subramaniyan, K. Ganesan, Discrete Mathematics, Tata Mc Graw Hill, New Delhi, 2000.
2. L. Lovarz, J. Pelikan, K. Vexztergombi, Discrete Mathematics, Springer International Edition, 2002.
3. N. Chandrasekaran M. Uma parvathi, Discrete Mathematics, PHI Learning P. Ltd. 2010.
4. Dr. M. K. Sen and Dr. B. C. Charraborthy, Introduction to Discrete Mathematics, Arunabha Sen Books & Allied Pvt. Ltd., 8/1 Chintamoni Das Lane, Kolkata – 700009, Reprinted in 2016.

Web Resources

1. https://ocw.mit.edu/courses/electrical-engineering-andcomputer-science/6-042j-mathematics-for-computer-science-fall-2005/

2. https://www.geeksforgeeks.org/set-theory/
3. https://www.includehelp.com/basics/set-theory-and-types-of-set-in-discrete-mathematics.aspx
4. http://discrete.openmathbooks.org/dmoi2/ch_graphtheory.html

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Solve discrete mathematics problems that involve: computing permutations and combinations of a set, fundamental enumeration principles and graph theory.	**K1, K2**
CO2	Demonstrate a working knowledge of set notation and elementary set theory, recognize the connection between set operations and logic, and prove elementary results involving sets.	**K3& K4**
CO3	Formulate and interpret statements presented in Boolean logic. Reformulate statements from common language to formal logic.	**K4, K5, K6**
CO4	Apply truth tables and the rules of propositional and predicate calculus	**K4**
CO5	Learn about Graph Theory.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	S
CO2	S	M	S	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	S	S	M
CO5	S	S	M	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core Practical – I	**Course Code:** 21PCS1P01		**Course Title:** Algorithms using C++ Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	2	100

Course Objectives

1. To develop skills in implementing algorithms through C++ and to explore the features of C++ by applying to solve Data structure problems.
2. To write programs in C++ to solve problems using divide and conquer strategy.
3. To write programs in C++ to solve problems using backtracking strategy.
4. To write programs in C++ to solve problems using greedy and dynamic programming techniques.

List of Programs

1. Apply the divide and conquer technique to arrange a set of numbers using merge sort.
2. Apply the divide and conquer technique to implement Quick sort.
3. Computer the transitive closure of a given directed graph using Warshall's Algorithm.
4. Implement 0/1 knapsack problem using Dynamic programming.
5. Find minimum cost spanning tree of a given undirected graph using Kruskal's Algorithm.
6. Find minimum cost spanning Tree of a given undirected graph using Prim's Algorithm.
7. Implement Queen's problem using backtracking.
8. Solve Dljkstra's Algorithm using greedy technique.
9. Implement Hamiltonian Circuit's problem using backtracking.
10. Solve subset sum problem using backtracking.

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Ability to apply the divide and conquer technique for solving problems.	**K1, K2**
CO2	Implemention of Dynamic Programming to solve knapsack problem	**K3 & K4**
CO3	Solve graph problems using algorithm design techniques such as Greedy.	**K4, K5, K6**
CO4	Implementation of backtracking techniques to solve various problems.	**K4**
CO5	Ability to write programs in C++ to solve various problems using algorithm design techniques.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	S	S
CO2	S	M	S	S	M	S
CO3	S	S	S	M	S	M
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core Practical – II	**Course Code:** 21PCS1P02		**Course Title:** Advanced Web Technology – Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	2	100

Course Objectives

1. Learn how to create websites using Asp.Net
2. Implement the advanced web concepts using Asp.Net and Ado.Net
3. Learn to use Asp.Net web controls
4. Design web applications using Asp.Net and Ado.Net

List of Applications

1. Simple application using web controls
    a) Finding factorial Value
    b) Money Conversion
2. Write a Program to generate the Login control.
3. Write a Program to perform Asp.Net state
4. Write a Program to create an Advertisement using Ad rotator.
5. Using Calendar control
    a) Display messages in a calendar
    b) Selected day in a calendar control using style
    c) Difference between two calendar dates
6. Write a Program to perform Tree view operation using data list
7. Write a Program to perform validation operation
8. Write a Program to insert, and Delete the data in to database using Execute-Non Query
9. Write a Program to bind data using template column in data grid.
10. Write a Program to implement paging concept data grid and dataset

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Apply .NET concepts to design and develop web applications	**K1, K2**
CO2	Create a basic website using ASP.Net concepts	**K3 & K4**
CO3	Design web page and connect to the backend databases	**K4, K5, K6**
CO4	Applying different functionalities in ASP.Net and ADO.Net	**K4**
CO5	Ability to create database oriented web applications with ADO.Net.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	M	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	S	S	S
CO5	S	S	M	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – V	**Course Code:** 21PCS2C05		**Course Title:** Distributed Operating System	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

1. To study Distributed operating system concepts
2. To understand hardware, software and communication in distributed OS
3. To learn the distributed resource management components.
4. Practices to learn concepts of OS and Program the principles of Operating Systems

UNIT – I

Distributed Operating Systems: Introduction- Issues – Communication Primitives – Inherent Limitations –Physical Clocks- Coordinated Universal Time- Christian Algorithm- Lamport's Logical Clock , Vector Clock, Global State , Cuts – Termination Detection.

UNIT – II

Distributed Mutual Exclusion – Non Token Based Algorithms – Lamport's Algorithm - Token Based Algorithms – Suzuki-Kasami's Broadcast Algorithm - Raymond's Tree Algorithm - Distributed Deadlock Detection – Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT – III

Distributed Resource Management – Distributed File Systems – Architecture – Mechanisms – Design Issues – Distributed shared Memory – Architecture – Algorithm – Protocols – Design Issues – Distributed Scheduling – Issues – Components – Algorithms.

UNIT – IV

Failure Recovery and Fault Tolerance – Concepts – Failure Classifications – Approaches to Recovery – Approaches to Recovery in Concurrent Systems – Synchronous and Asynchronous Check Pointing and Recovery – Check pointing in Distributed Database

Systems – Fault Tolerance Issues – Two-Phase and Nonblocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols.

UNIT – V

Multiprocessor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory Management – Reliability/Fault Tolerance – Database Operating Systems – Concepts – Features of Android OS, Ubuntu, Google Chrome OS and Linux Operating Systems.

Text Books

1. MukeshSinghalN.G.Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill 2000.
2. Distributed Operating System – Andrew S. Tanenbaum, PHI.

Reference Books

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne, "Operating Concepts", 6th Edition Addison Wesley publications 2003.
2. Andrew S.Tanenbaum, "Modern Operating Systems", 2nd Edition Addison Wesley 2001.

Web Resources

1. https://www.tutorialspoint.com/distributed-operating-system
2. https://www.geeksforgeeks.org/types-of-operating-systems/
3. https://examupdates.in/operating-system-pdf/
4. http://stst.elia.pub.ro/news/SO/Modern%20Operating%20System%20-20Tanenbaum.pdf

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Clear understanding on several resource management techniques like distributed shared memory and other resources.	**K1, K2**
CO2	Knowledge on mutual exclusion and Deadlock detection of Distributed operating system.	**K3 & K4**
CO3	Able to design and implement algorithms of distributed shared memory and commit protocols.	**K4, K5, K6**
CO4	Able to design and implement fault tolerant distributed systems	**K4**
CO5	Learn the structure and design issues of Multiprocessor and Database Operating Systems.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	M
CO2	S	M	S	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	M	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – VI	**Course Code:** 21PCS2C06		**Course Title:** Advanced Java Programming	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	45	4	100

Course Objectives

1. To deepen student's programming skills by analyzing the real world problem in a programmer's point of view and implement the concepts in real time projects in Java.
2. To learn basics of Java programming concepts like Packages, Applets, Database Connectivity Enable the students to learn network programs in Java
3. Acquire Knowledge about JDBC and Servlet.

UNIT – I

An Overview of Java: Object Oriented Programming - Lexical Issues - Class Libraries. Data Types, Variables, and Arrays: Primitive Types – LiteralsVariables - Type Conversion and Casting- Arrays. Classes and Methods: Fundamentals - Declaring objects - Methods – Constructors - Overloading Methods.

UNIT – II

Inheritance: Basics - Super Class - Method overriding - Abstract Class. Packages and Interfaces: Packages - Access Protection - Importing Packages - Interfaces. Exception Handling: Fundamentals - types- Uncaught Exceptions- Try and Catch- throw-throws-finally-built-in exceptions.

UNIT – III

Multi-threaded programming: Thread Model-Creating a Thread- Thread Priorities-SynchronizationInterthread Communication. Input /Output: The I/O Classes and Interfaces – File - I/O Exceptions - Byte Streams - Character Steams – Serialization. The Applet Class: Basics-Architecture - Applet Skeleton - Display methods – Status Window - Passing Parameters.

UNIT – IV

AWT: AWT Classes - Window Fundamentals - Working with Frame Windows – Graphics – Working with Color - Working with Fonts. JavaBeans: Advantages - Introspection – Properties - Java Beans API. Servlets: Life Cycle - Simple Servlet - Cookies - session tracking.

UNIT – V

Using Relational Databases: Introduction- JDBC Drivers for RDBM Systems – Using Java.sql API - Using Javax.sql API - Connection Pooling. Network Programming: Introduction - Working with URLs - Working with Sockets - Remote Method Invocation.

Text Books

1. Herbert Schildt, "The Complete Reference Java J2SE", 9th ed., TMH Publishing Company Ltd, New Delhi, 2014.Chapter: 2-11, 16, 22, 23,24,25,26,37,38
2. Joe Wiggles worth and Paula McMillan, "Java Programming Advanced Topics", 3rd ed., TMH, 2009.Chapter: 9, 11

Reference Books

1. John Dean, Raymond Dean, " Introduction to Programming with JAVA – A Problem Solving Aproach", Tata McGrawHil, 2012
2. Ralph Bravaco, Shai Simonson, "Java Programming : From the Ground Up", Tata McGraw Hil Edit on, 2012
3. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", Tata McGrawHil, 2013

Web Resources

1. https://www.udemy.com/course/advanced-java-programming/
2. https://www.w3schools.in/java-tutorial/
3. https://beginnersbook.com/java-tutorial-for-beginners-with-examples/
4. https://www.tutorialspoint.com/java/index.htm

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Able to understand basics of Java programming	**K1, K2**
CO2	Create ability to handle exceptions in Java.	**K3 & K4**
CO3	Able to develop a Graphical User Interface (GUI) with Applet and Swing.	**K4, K5, K6**
CO4	Create interactive applications using AWT components.	**K4**
CO5	Understand JDBC and Network programming concepts in Java.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	S	S
CO2	S	S	S	M	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – VII	**Course Code:** 21PCS2C07		**Course Title:** Cryptography and Network Security	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	45	4	100

Course Objectives

1. To understand the cryptography theories and algorithms.
2. To understand necessary approaches and techniques to build protection mechanisms in order to secure computer networks.
3. To know about the malicious software & firewalls.

UNIT – I

Introduction - Security Trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of Network Security – Security Attacks, Services and Mechanisms – OSI Security Architecture – Classical Encryption Techniques: Substitution Techniques, Transposition Techniques, Steganography- Foundations of Modern Cryptography: Perfect Security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT – II

Symmetric Encryption and Message Confidentiality - Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4 , Chipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.

UNIT – III

Authentication Applications - Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

UNIT – IV

IP Security - IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.

UNIT – V

Intruders – Intruders, Intrusion Detection, Password Management. Malicious Software: Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted System, Common Criteria for Information Technology Security Evaluation.

Text Books

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007, Reprint 2015.
2. Stallings William, "Cryptography and Network Security - Principles and Practice 2017.
3. William Stallings, "Network Security Essentials Applications and Standards "Third Edition, Pearson Education, 2008.

Reference Books

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms And Protocols", Wiley Publications, 2003.
2. Charles Pfleeger, "Security In Computing", 4th Edition, Prentice Hall Of India, 2006.
3. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
4. Charlie Kaufman And Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication In Public World", PHI 2002.
5. Bruce Schneier And Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
6. Douglas R Simson "Cryptography – Theory And Practice", First Edition, CRC Press, 1995.

Web Resources

1. https://www.geeksforgeeks.org/cryptography-introduction/
2. http://www.cse.iitm.ac.in/~chester/courses/16e_cns/slides/01_Introduction.pdf

3. http://www.vssut.ac.in/lecture_notes/lecture1428550736.pdf

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.	**K1, K2**
CO2	Apply the different cryptographic operations using symmetric cryptographic algorithms.	**K3 & K4**
CO3	Apply the different cryptographic operations using public key cryptography.	**K4, K5, K6**
CO4	Apply the various Authentication schemes to simulate different applications.	**K4**
CO5	Understand various Security practices and System security standards	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	S	M	S	S	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	M
CO5	S	S	S	S	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core Practical – III	**Course Code:** 21PCS2P03		**Course Title:** Advanced Java Programming Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	2	100

Course Objectives

1. To enable the students to implement different java packages.
2. To develop the students with the skills to implement different java tools.
3. Learn to use Asp.Net web controls
4. Design web applications using Asp.Net and Ado.Net

List of Programs

Use JAVA Programming Language to implement the following:

1. To create applets incorporating the following Features:
   a. Create a color palette with matrix of buttons
   b. Set background and foreground of the control text area by selecting a color from color palette.
   c. In order to select Foreground or background use check box control as radio buttons
   d. To set background images
2. Use GridLayout to design a calculator and simulate the functions of simple calculator.
3. To create Input output and Random files
4. To develop chat application with datagram sockets and datagram packets.
5. To invoke servlet from HTML forms.
6. To invoke servlet from Applets.
7. To invoke servlet from JSP.
8. Simple client/server application.
9. JDBC to interact with database.
10. To create multiple chat applications using TCP packets.

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Learn the Internet Programming, using Java Applets.	**K1, K2**
CO2	Apply event handling on AWT and Swing components.	**K3 & K4**
CO3	Create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings.	**K4, K5, K6**
CO4	Learn to access database through Java programs, using Java Data Base Connectivity (JDBC).	**K4**
CO5	Create dynamic web pages, using Servlets and JSP.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core Practical – IV	**Course Code:** 21PCS2P04		**Course Title:** DOS Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	2	100

Course Objectives

1. Understand the design aspects of operating system.
2. Exposure on usage of various operating systems.
3. Design modern distributed system components

List of Experiments

1. Simulate the following CPU scheduling algorithms
   a) Round Robin b) SJF c) FCFS d) Priority
2. Simulate all file allocation strategies
   a) Sequential b) Indexed c) Linked
3. Implement process strategies: creation of child, zombie, orphan process
4. Implement file organization strategies
   a) single level b) Two level c) Hierarchical
5. Simulate Bankers Algorithm for Dead Lock Avoidance
6. Simulate Bankers Algorithm for Dead Lock Prevention
7. Simulate all page replacement algorithms
   a) FIFO b) LRU c) LFU
8. Implement shared memory and semaphore concepts for inter process communication

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the simulation of CPU scheduling algorithms and file allocation strategies.	**K1, K2**
CO2	Develop distributed application using file allocation strategies.	**K3 & K4**
CO3	Construct the program to demonstrate concept of centralized and distributed deadlock.	**K4, K5, K6**
CO4	Build distributed application to illustrate the concept of Page replacement algorithms.	**K4**
CO5	Build the program to demonstrate concept of distributed mutual exclusion and process synchronization.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	M	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – VIII	**Course Code:** 21PCS3C08		**Course Title:** Digital Image Processing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

1. Understand the fundamental concept of Digital Image Processing.
2. To provide complete knowledge on Digital Image Processing methods in Spatial domain and Frequency domain, Edge detection, Compression, Segmentation.
3. Learn Morphological concepts, which enable the students to understand the concepts and implement them empirically.

UNIT – I

Introduction: What is Digital Image Processing? – Examples of Fields that Use Digital Image Processing – Fundamental Steps in Digital Image Processing – Components of an Image processing System**. Fundamentals:** Image Sensing and Acquisition, Image Sampling and Quantization, Relationship Between Pixels.

UNIT – II

The Image, its Mathematical Background: Overview – Linear Integral Transforms. Data Structures for Image Analysis: Level of Image Data Representation – Traditional Image Data Structures – Hierarchical Data structures. Image Pre-processing: Pixel Brightness Transformations - Geometric transformations – Local pre-processing: Image smoothing, Edge Detectors – Image Restoration.

UNIT – III

Segmentation : Thresholding – Edge Based Segmentation : Edge Image Thresholding, Border tracing - Region Based Segmentation – Matching – Shape Representation and **Description:** Region Identification – Contour Based Shape Representation and Description-Chain codes, Simple Geometric Border Representation - Region Based Shape Representation and Description, Simple Scalar Region Descriptors.

UNIT–IV

Object recognition: Knowledge Representation – Statistical Pattern Recognition – Neural Nets – Fuzzy Systems- Mathematical Morphology – Basic Morphological concepts – Binary Dilation and Erosion.

UNIT – V

Image Data Compression: Image Data Properties – Discrete Image Transforms in Image Data Compression – Predictive Compression Methods – Vector Quantization – Hierarchal and Progressive Compression Methods – Comparison of Compression Methods – Coding – JPEG Image Compression.

Text Books

1. Rafael C. Gonzalez, Richard E.Woods, Digital Image Processing, Prentice Hall, Third Edition, 2008. (Unit-1: Chapter 1-1.1, 1.3, 1.4, 1.5, Chapter 2 -2.1, 2.2, 2.3, 2.4, 2.5).
2. Sonka, Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning, 2009 (Unit -II: Chapter 3 – 3.1, 3.2 ,Chapter-4, Chapter-5,5.1, 5.2,5.3, 5.3.1, 5.3.2, 5.4 Unit-III: Chapter-6-6.1, 6.2, 6.2.1, 6.2.3., 6.3, 6.4, Chapter 8 – 8.1, 8.2,8.2.1,8.2.2, 8.3, 8.3.1 Unit-IV- 4 – Chapter 9,9.1,9.2, 9.3,9.7, Chapter 13-13.1, 13.3 Unit-5: Chapter 14- 14.1, 14.2, 14.3, 14.4, 14.5,14.6, 14.8, 14.9,14.9.1)

Reference Books

1. B. Chan la, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.
2. Nick Elford, “Digital Image Processing a practical introducing using Java”, Pearson Education, 2004.
3. Todd R.Reed, “Digital Image Sequence Processing, Compression, and Analysis”, CRC Press, 2015.
4. L.Prasad, S.S.Iyengar, “Wavelet Analysis with Applications to Image Processing”, CRC Press, 2015.

Web Resources

1. https://www.geeksforgeeks.org/digital-image-processing-basics/
2. http://sdeuoc.ac.in/
3. http://www.imageprocessingplace.com/

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Review the fundamental concepts of a digital image processing system.	**K1 & K2**
CO2	Analyze images in the frequency domain using various transforms.	**K1 & K2**
CO3	Evaluate the techniques for image enhancement and image restoration. Categorize various compression techniques	**K2**
CO4	Interpret Image compression standards, and Interpret image segmentation and representation techniques.	**K2**
CO5	Gain idea to process various image used in various fields such as weather forecasting, Diagnosis of various deasease using image such as tumor, cancer etc	**K3**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	M
CO3	S	S	S	S	S	S
CO4	S	S	S	M	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – IX	**Course Code:** 21PCS3C09		**Course Title:** Internet of Things	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

1. To understand Smart Objects and IoT Architectures
2. To learn about various IOT - related protocols
3. To develop IoT infrastructure for popular applications
4. Understand the concept of the Web of Things and the relationship between the IoT and WoT.

UNIT – I

INTRODUCTION To IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels and Deployment Templates - Domain Specific IoTs - IoT Platforms Design Methodology.

UNIT – II

IoT and M2M- Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

UNIT – III

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

UNIT – IV

Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor

DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor.

UNIT – V

IoT Physical Servers and Cloud Offerings– Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API.

Text Book

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.

Reference Books

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
2. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

Web Resources

1. https://en.wikipedia.org/wiki/Internet_of_things
2. https://www.zdnet.com/
3. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT
4. https://books.google.co.in/books/about/Internet_of_Things.html
5. https://nasrinword.files.wordpress.com/2018/05/internet-of-things-a-hands-on-approach-ref-1.pdf.

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Gain the basic knowledge about IoT and they will be able to use IoT related products in real life.	**K1 & K2**
CO2	Understand IoT Access Architecture and Protocols.	**K1 & K2**
CO3	Helps to rely less on physical resources and started to do their work smarter.	**K2**
CO4	Describe Design & Development of	**K3**
CO5	IoT Know IoT supporting services.	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	S	M	S
CO4	S	S	S	S	S	M
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – X	**Course Code:** 21PCS3C10		**Course Title:** Machine Learning	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

1. To Learn about Machine Intelligence and Machine Learning applications
2. To implement and apply machine learning algorithms to real-world applications.
3. To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
4. 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. EthemAlpaydin, 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.

Web Resources

1. http://profsite.um.ac.ir/~monsefi/machine-learning/pdf/Machine-Learning-Tom-Mitchell.pdf
2. http://robotics.stanford.edu/people/nilsson/MLBOOK.pdf
3. https://machinelearningmastery.com/types-of-learning-in-machine-learning/
4. https://towardsdatascience.com/machine-learning-an-introduction-23b84d51e6d0

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Have a good understanding of the fundamental issues and challenges of machine learning	**K1 & K2**
CO2	Have an understanding of the strengths and weaknesses of many popular machine learning approaches.	**K1 & K2**
CO3	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	**K2**
CO4	Know about Instant based Learning and Advanced Learning.	**K3**
CO5	Be able to design and implement various machine learning algorithms in a range of real-world applications	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	M
CO3	S	S	S	S	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	M	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core – XI	**Course Code:** 21PCS3C11		**Course Title:** Data Analytics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

1. To introduce the concept of Big Data Analytics.
2. To learn basic and advanced methods of big data technology and tools, including MapReduce and Hadoop and its ecosystem.
3. To enable students to learn machine learning.
4. To make students well versed with MapReduce Hadoop.

UNIT – I

Introduction to Big Data Analytics : Big Data Overview – Data Structures – Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Analytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize.

UNIT – II

Basic Data Analytic Methods Using R : Introduction to R programming – R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis : Visualization Befor Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation – Statistical Methods of Evaluation : Hypothesis Testing – Difference of Means – Wilcoxon Rank- Sum Test – Type I and Type II Errors – Power and Sample Size – ANOVA.

UNIT – III

Advanced Analytical Theory and Methods: Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics – Reasons to Choose and Cautions – Additional Algorithms - Association Rules : A Priori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Validation and Testing – Diagnostics.

Regression : Linear Regrression and Logistic Regression:– Use cases – Model Description – Diagnostics - Additional Regression Models.

UNIT – IV

Classification : Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Na‟ive Bayes – Bayes Theorem – Naïve Bayes Clasifier – Smoothing – Diagnostics – Naïve Bayes in R – Diagnostics of Classifiers – Additional Classification Methods - Time Series Analysis : Overview – Box – Jenkins Methodology – ARIMA Model – Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models – Building and Evaluating and ARIMA Model - Text Analysis : Text Analysis Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights.

UNIT – V

Advanced Analytics - Technology and Tools: MapReduce and Hadoop : Analytics for Unstructured Data - UseCases - MapReduce - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – Manout – NoSQL - Tools in Database Analytics : SQL Essentials – Joins – Set Operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – Ordered Aggregates- MADiib – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables : Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach – Model Description.

Text Book

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services Published by John Wiley & Sons, Inc. 2015.

Reference Books

1. Noreen Burlingame , “The little book on Big Data”, New Street publishers, 2012.
2. Anil Maheshwari, “ Data Analytics”, McGraw Hill Education, 2017.
3. Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press; 1 edition , 2011.
4. Sandip Rakshit, “R for Beginners”, McGraw Hill Education, 2017

Web Resources

1. http://www.johndcook.com/R_language_for_programmers.html.
2. http://bigdatauniversity.com/.
3. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction.
4. https://www.simplilearn.com/data-science-vs-big-data-vs-data-analytics-article

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Learn the concept of big data analytics.	**K1**
CO2	Able to participate data science and big data analytics projects	**K1 & K2**
CO3	Apply the knowledge of Query Language	**K3**
CO4	Build programs using NoSQL	**K3**
CO5	Apply the concepts of R Tool.	**K3**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	M	M	S	S	S	S
CO3	S	S	S	S	S	S
CO4	S	S	S	S	M	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Core Practical – V	**Course Code:** 21PCS3P05		**Course Title:** Data Analytics Lab	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	5	75	2	100

Course Objectives

1. To implement mathematical aggregation operators in "R-script".
2. To understand the Statistical operations in "R".
3. Apply classification algorithms in R.

List of Experiments

1. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R.
2. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R.
3. To get the input matrix from user and perform Matrix addition, subtraction, multiplication, inverse transpose and division operations using vector concept in R.
4. To perform statistical operations (Mean, Median, Mode and Standard deviation) using R.
5. To perform data pre-processing operations i) Handling Missing data ii) Min- Max normalization
6. To perform dimensionality reduction operation using PCA for Houses Data Set
7. To perform Simple Linear Regression with R.
8. To perform K-Means clustering operation and visualize for iris data set
9. Write R script to diagnose any disease using KNN classification and plot the results.
10. To perform market basket analysis using Association Rules (Apriori).

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Perform numerical, mathematical and statistical operations in R.	**K1, K2**
CO2	Import and export data using data frame in R.	**K3 & K4**
CO3	Perform data preprocessing, dimensionality reduction operations in R.	**K4 & K5**
CO4	Work with Simple Linear Regression and K-Means clustering algorithms.	**K4**
CO5	Understand the classification and association rule algorithms.	**K5, K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	M	S
CO3	S	S	S	S	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Project	**Course Code:** 21PCS3PR01		**Course Title:** Mini Project	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	5	75	4	100

Course Objectives

1. To implement the concepts of SDLC.
2. To experience development of real time applications.
3. To practice the students rapid application development.

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Develop knowledge in Software project.	**K1**
CO2	Understand the concept and challenges in Software Project Management	**K1**
CO3	To analyse the issues in developing applications.	**K2**
CO4	Gain hands-on experience on systematic approach in project development.	**K3**
CO5	Can experience the bottlenecks of various languages and solve it.	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – I	**Course Code:** 21PCS1E01		**Course Title:** Software Project Management	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

1. Understand the framework of project management
2. Learn to monitor and control the project
3. Know the sound knowledge in Agile method
4. Know the team, cost, quality and resource management
5. Identify and control the risk in the projects

UNIT – I

Project Management Framework: Introduction: Project - Project management - Relationship among Project, Program and Portfolio management - Project and Operations Management- Role of Project Manager - Project Management Body of Knowledge - Enterprise Environmental Factors. Project Life Cycle and Organization: Overview of Project life Cycle - Projects vs Operational Work - Stakeholders - Organizational Influences on Project Management. **The Standard for Project Management of a Project**: Project Management Processes for a Project: Common Project Management Process Interactions - Projects Management Process Groups - Initiating Process Group - Planning Process Group - Executing Process Group - Monitoring and Controlling Process Group - Closing Process Group.

UNIT – II

Choosing Methodologies and Technologies – Software Processes and Process Models – Choice of Process Models – The Waterfall Model– Prototyping – Other Ways of Categorizing Prototype - **Agile Methods** – Extreme Programming Selecting the Most Appropriate Process Model- Need of Agile - Iterative vs Incremental-Agile Manifesto and Mindset – Lean, Scrum and Kanban Methods-Uncertainty, Risk, and Lifecycle Selection-Scrum Elements Overview-5 Levels of Planning-Scrum Process Overview-Agile Team-Roles and Responsibilities- Epic-Feature-User Stories-PBI-The Sprint.

UNIT – III

The Project Management Knowledge Areas: Project Integration Management: Develop Project Charter - Develop Project Management Plan - Direct and Manage Project Execution - Monitor and Control Project Work - Perform Integrated Change Control - Close Project or Phase. Project Scope Management: Collect Requirements - Define Scope - Create WBS - Verify Scope - Control Scope. Project Team Management: Define Activities - Sequence Activities - Estimate Activity Resources - Estimate Activity Durations - Develop Schedule - Control Schedule.

UNIT – IV

Project Cost Management: Estimate Costs - Determine Budget - Control Costs. Project Quality Management: Plan Quality - Perform Quality Assurance - Perform Quality Control. Project Human Resource Management: Develop Human Resource Plan - Acquire Project Team - Develop Project Team - Manage Project Team. Project Communications Management: Identify Stakeholders - Plan Communications - Distribute Information - Manage Stakeholder Expectations - Report Performance.

UNIT – V

Project Risk Management: Plan Risk Management - Identify Risks - Perform Qualitative Risk Analysis - Perform Quantitative Risk Analysis - Plan Risk Responses - Monitor and Control Risks. Project Procurement Management: Plan - Conduct - Administer - Close procurements.

Text Books

1. A guide to the Project management Body of Knowledge (PMBOK Guide)" Fouth Edition, Project Management Institute, Pennsylvania, 2008
2. BOB Huges, Mike Cotterell, Rajib Mall “Software Project Management”, McGraw Hill, Fifth Edition,2011.
3. Emerson, "Agile Handbook," Philosophie

Reference Books

1. Futrell, “Quality Software Project Management”, Pearson Education India.
2. Royce, “Software Project Management”, Pearson Education India.

3. C.Ravindranath Pandian, "Applied Software Risk Management-A Guide for Software Project Managers", Auerbach Publications, 2015.
4. Benjamin A. Lieberman, "The Art of Software Modeling", Auerbach Publications, 2010.

Web Resources

1. http://www.cs.bilkent.edu.tr/~cagatay/cs413/PMBOK.pdf
2. http://www.orange.ngo/wp-content/uploads/2016/09/PMBOK-Guide-5th-Edition-PMI.pdf
3. https://books.google.co.in/

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Analyze the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders.	**K1**
CO2	Align the project to the organization's strategic plans and business justification throughout its lifecycle	**K1 & K2**
CO3	Identify project goals, constraints, deliverables, performance criteria, control needs, and resource requirements in consultation with stakeholders.	**K3**
CO4	Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.	**K3**
CO5	Adapt projects in response to issues that arise internally and externally.	**K3**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	S	S	S	M	S
CO3	S	S	S	S	S	S
CO4	S	S	M	S	S	S
CO5	S	S	S	S	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – I	**Course Code:** 21PCS1E02		**Course Title:** Wireless Networks	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

1. To impart adequate knowledge of wireless communication
2. To Study about Wireless Networks, Protocol Stack and Standards.
3. To Study about Fundamentals of 3G Services, Its Protocols and Applications.
4. To Study about Evolution of 4G Networks, its Architecture and Applications.

UNIT – I

WIRELESS LAN - Introduction-WLAN Technologies: Infrared, UHF Narrowband, Spread Spectrum -IEEE802.11: System Architecture, Protocol Architecture, Physical Layer, MAC Layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband Layer, Link Manager Protocol, Security – IEEE802.16-WIMAX: Physical Layer, MAC, Spectrum Allocation For WIMAX

UNIT – II

MOBILE NETWORK LAYER - Introduction – Mobile IP: IP Packet Delivery, Agent Discovery, Tunneling And Encapsulation, IPV6-Network Layer In The Internet- Mobile IP Session Initiation Protocol – Mobile Ad-Hoc Network: Routing, Destination Sequence Distance Vector, Dynamic Source Routing.

UNIT – III

CELLULAR ARCHITECTURE

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations – Cellular concept - Frequency reuse - channel assignment - hand off - interference & system capacity - trunking & grade of service – Coverage and capacity improvement.

UNIT – IV

WIRELESS WIDE AREA NETWORK - Overview Of UTMS Terrestrial Radio Access Network-UMTS Core Network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High Speed Downlink Packet Access (HSDPA)- LTE Network Architecture And Protocol.

UNIT – V

4G NETWORKS - Introduction – 4G Vision – 4G Features And Challenges – Applications Of 4G – 4G Technologies: Multicarrier Modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation And Coding with Time Slot Scheduler, Cognitive Radio.

Text Books

1. Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg , “Wireless Communications And Networking”, First Edition, Elsevier 2014.(Unit IV,V)

Reference Books

1. Erik Dahlman, Stefan Parkvall, Johan Skold And Per Beming, “3G Evolution HSPA And LTE For Mobile Broadband”, Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy Kuri, “Wireless Networking”, First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, “Modern Wireless Communications”, First Edition, Pearson Education 2013.
4. David G. Messerschmitt, “Understanding Networked Applications”, Elsevier, 2010

Web Resources

1. https://sgar91.files.wordpress.com/2011/10/mobile_communications_schiller_2e.pdf
2. https://www.ibr.cs.tu-bs.de/courses/ss11/mk/material/mk-ss11-slides-ch01.pdf
3. https://www.tutorialspoint.com/Wireless-Networks
4. https://commotionwireless.net/docs/cck/networking/types-of-wireless-networks/

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Students will get the knowledge of wireless communication	**K1**
CO2	Knows the structures and standards of wireless communication	**K1 & K2**
CO3	Conversant With The Latest 3G/4G And WiMAX Networks And Its Architecture.	**K3**
CO4	Design and Implement Wireless Network Environment For Any Application Using Latest Wireless Protocols And Standards.	**K4**
CO5	Implement Different Type Of Applications For Smart Phones And Mobile Devices With Latest Network Strategies	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	M
CO2	S	M	S	S	S	S
CO3	S	S	S	S	M	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – I	**Course Code:** 21PCS1E03		**Course Title:** Object Oriented System Development	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

1. Introduce the concept of Object-oriented design and understand the fundamentals of OOSD life cycle.
2. Familiar with evolution of object-oriented model, classes and it notations
3. Practice UML in order to express the design software projects.
4. Specify, analyze and design the use case for a particular system.
5. Enrich knowledge about DBMS, designing classes and object oriented testing.

UNIT – I

Fundamentals of OOSD - Overview of Object Oriented Systems Development : Two Orthogonal View of the Software - OOSD Methodology - Why an Object Object Orientation. Object Basics: Object Oriented Philosophy- Objects – Attributes – Object Respond to Messages – Encapsulation and Information Hiding – Class Hierarchy – Polymorphism – Object Relationship and Associations. OOSD Life Cycle : Software Development Process – OOSD Use Case Driven Approach – Reusability.

UNIT – II

Methodology, Modeling and UML - Object Oriented Methodologies: Rumbaugh et al.'s Object Modeling Technique – The Booch Methodology – The Jacobson et al. Methodology – Patterns – Frameworks - The Unified Approach. Unified Modeling Language : Static and Dynamic Models – Why Modeling - UML Diagrams – UML Class Diagram – Use Case Diagram - UML Dynamic Modeling – Packages and Model Organization.

UNIT – III

Object Oriented Analysis - Object Oriented Analysis Process : Business Object Analysis - Use Case Driven Object Oriented Analysis – Business Process Modeling – Use-Case model – Developing Effective Documentation . Classification : Classifications Theory – Approaches

for Identifying Classes – Noun Phrase Approach – Common Class Patterns Approach – Use-Case Driven Approach – Classes, Responsibilities, and Collaborators - Naming Classes. Identifying Object Relationships, Attributes, and Methods : Association – Super-Sub Class Relationship – Aggregation – Class Responsibility – Object Responsibility.

UNIT – IV

Object Oriented Design - Object Oriented Design Process and Design Axioms - OOD Process- OOD Axioms – Corollaries – Design Patterns. Designing Classes : Designing Classes – Class Visibility – Refining Attributes – Designing Methods and Protocols – Packages and Managing Classes. Access Layer: Object Store and Persistence – DBMS – Logical and Physical Database Organization and Access Control – Distributed Databases and Client Server Computing — Multidatabase Systems – Designing Access Layer Classes. View Layer : Designing View Layer Classes – Macro Level Process – Micro Level Process – The Purpose of View Layer Interface – Prototyping the User Interface.

UNIT – V

Software Quality - Software Quality Assurance : Quality Assurance Tests – Testing Strategies – Impact of Object Orientation on Testing - Test Cases- Test Plan – Continuous Testing. System Usability and Measuring User Satisfaction: Usability Testing – User Satisfaction test – A tool for Analyzing User Satisfaction. System Usability and Measuring User Satisfaction : Introduction – Usability Testing.

Text Book

1. Ali Bahrami, “Object Oriented Systems Development using UML”, McGraw-Hill, 2008

Reference Books

1. Booch Grady, Rumbaugh James, Jacobson Ivar, “The Unified modeling Language – User Guide, Pearson Education, 2006
2. Brahma Dathan, Sarnath Ramnath, “Object Oriented Analysis, Design and Implementation”, Universities Press, 2010.
3. Mahesh P.Matha, “Object-Oriented Analysis and Design Using UML”, PHI Learning Private Limited, 2012.
4. Rachita Misra, Chhabi Rani Panigrahi, Bijayalaxmi Panda, “Principles of Software Engineering and System Design”, Yesdee Publishing 2019.

Web Resources

1. https://www.tutorialspoint.com/

2. https://javajee.com/introduction-to-object-oriented-systems-development

3. https://www.uml-diagrams.org/uml-object-oriented-concepts.html

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Show how the object-oriented approach differs from the traditional approach to systems analysis and design.	**K1**
CO2	Analyze, design, document the requirements through use case driven approach	**K1 & K2**
CO3	Explain the importance of modeling and how the Unified Modeling Language (UML) represents an object-oriented system using a number of modeling views.	**K3**
CO4	Recognize the difference between various object relationships: inheritance, association and aggregation.	**K4**
CO5	Show the role and function of test cases, testing strategies and test plans in developing object-oriented software.	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	M	M	S	S	S	M
CO3	S	S	S	S	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	M	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 21PCS2E04		**Course Title:** Data Mining and Warehousing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	45	4	100

Course Objectives

1. Learn the basics of Data Mining and Data Warehousing.
2. To recognize the various data mining and warehousing tools
3. To develop the proficiency for planning & applying the DM techniques.

UNIT – I

Data Mining And Data Preprocessing: Data Mining – Motivation – Definition – Data Mining on Kind of Data –Functionalities – Classification – Data Mining Task Primitives – Major Issues in Data Mining – Data Preprocessing – Definition – Data Clearing – Integration and Transformation – Data Reduction.

UNIT – II

Data Warehousing: Multidimensional Data Model –Data Warehouse Architecture – Data Warehouse Implementation –From data Warehousing to Data Mining – Online Analytical Processing - Online Analytical Mining.

UNIT – III

Frequent Patterns, Associations And Classification: The Apriori Algorithm – Definition of Classification and Prediction – Classification by Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Lazy Learners – K-Nearest Neighbor – Other Classification Methods.

UNIT – IV

Cluster Analysis: Definition – Types of data in Cluster Analysis – Categorization of major Clustering Techniques – Partitioning Methods – Hierarchical Clustering – BIRCH - ROCK – Grid Based Methods – Outlier Analysis.

UNIT – V

Spatial, Multimedia, Text And Web Data: Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web – Data Mining Applications – Trends in Data Mining.

Text Books

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques, 3rd Edition, July 6, 2011.
2. Ian H. Witten, 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-Instructor's Solution Manual", Pearson Education, First Edition, 2016.
4. Mohammed J.Zaki, Wagner Meira JR, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge India, 2016.

Web Resources

1. shttp://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf
2. http://ccs1.hnue.edu.vn/hungtd/DM2012/DataMining_BOOK.pdf

Course Outcomes (CO)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the basics of DataMining & DataWarehousing.	**K1**
CO2	Identify the appropriate Data Mining techniques for problem solving	**K2**
CO3	Demonstration of various data mining techniques and ware housing tool	**K3**
CO4	Implement the classification and clustering techniques	**K4**
CO5	Aware about Spatial, Multimedia and Text Mining	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	S	S	S	S	S
CO3	S	S	S	S	M	S
CO4	S	M	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 21PCS2E05		**Course Title:** Compiler Design	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	45	4	100

Course Objectives

1. Discover principles, algorithms and techniques that can be used to construct various phases of compiler.
2. Acquire knowledge about finite automata and regular expressions.
3. Learn the concept of context free grammars, compiler parsing techniques.
4. Explore knowledge about Syntax Directed definitions and translation scheme.
5. Understand intermediate machine representations and actual code generation

UNIT – I

Lexical analysis - Language Processors, The Structure of a Compiler, Parameter Passing Mechanism – Symbol Table - The Role of the Lexical Analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens – Finite Automata - Regular Expression to Automata.

UNIT – II

Syntax Analysis - The Role of the Parser - Context-Free Grammars - Writing a Grammar - Top Down Parsing - Bottom-Up Parsing - LR Parsers- LALR Parsers.

UNIT – III

Semantic Analysis - Inherited and Synthesized Attributes – Dependency Graphs – Ordering the Evaluation of Attributes – S-attributed Definitions – L-attributed Definitions – Applications of Syntax Directed Translation – Syntax Directed Translations Schemes - Storage Organization – Stack Allocation of Space.

UNIT – IV

Intermediate Code Generation - Variants of Syntax Trees – Three Address Code – Types and Declarations - Translation of Expressions – Type Checking - Control Flow - Back Patching - Switch Statements - Procedure Calls.

UNIT – V

Code Generation and Code Optimization - Issues in the Design of a Code Generator - The Target Language – Address in the Target Code – Basic Block and Flow Graphs – Optimization of Basic Blocks - A Simple Code Generator – Peephole Optimization.

Text Book

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers- Principles, Techniques and Tools", Second Edition, Pearson Education Asia, 2009.

Reference Books

1. A.V. Aho, Ravi Sethi, J.D. Ullman, Compilers - Principles, Techniques and Tools, Addison- Wesley, 2003.
2. Fischer Leblanc, Crafting Compiler, Benjamin Cummings, Menlo Park, 1988.
3. Kennath C.Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
4. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2001.
5. S.Godfrey Winster, S.Aruna Devi, R.Sujatha, "Compiler Design", yesdee Publishers, Third Reprint 2019.

Web Resources

1. http://index-of.es/Varios-2/Compilers.pdf
2. http://turbo51.com/download/Compilers-Principles-Techniques-and-Tools-Book-Preview.pdf
3. http://www.crectirupati.com/sites/default/files/lecture_notes/COMPILER%20DESIGN%20NOTES.pdf

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Posses knowledge about finite automata and regular expressions.	**K1**
CO2	Understand Lexical, syntax and Semantic analysis	**K2**
CO3	Learn the concept of context free grammars, compiler parsing techniques.	**K2**
CO4	Learn Code Generation and Code Optimization	**K2**
CO5	Use the knowledge of patterns, tokens & regular expressions for solving a problem in the field of data mining.	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	S	M	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – II	**Course Code:** 21PCS2E06		**Course Title:** Embedded Systems	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	45	4	100

Course Objectives

1. To teach all aspects of design and development of an embedded System.
2. To understand hardware and software of development system.
3. Describe the hardware software co-design and firmware design approaches.
4. Know the RTOS internals, multitasking, task scheduling, task communication and synchronization.
5. Learn the development life cycle of embedded system.

UNIT – I

Introduction to Embedded System - Embedded System vs General Computing Systems - History - Classification - Major Application Areas - Purpose of Embedded systems - Smart Running Shoes: The Innovative Bonding of Lifestyle with Embedded Technology. Characteristics and Quality Attributes of Embedded Systems.

UNIT – II

Elements of an Embedded System - Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, COTS - Memory - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces - Embedded Firmware - Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real-Time Clock, and Watchdog Timer - PCB and Passive Components.

UNIT – III

Embedded Systems - Washing Machine: Application-Specific - Automotive: Domain Specific. Hardware Software Co-Design - Computational Models - Embedded Firmware Design Approaches - Embedded Firmware Development Languages - Integration and Testing of Embedded Hardware and Firmware.

UNIT – IV

RTOS based Embedded System Design: Operating System Basics - Types of Operating Systems - Tasks, Process and Threads - Multiprocessing and Multitasking - Task Scheduling- Task Communication - Task Synchronisation - Device Drivers - Choosing an RTOS.

UNIT – V

Components in Embedded System Development Environment, Files Generated During Compilation, Simulators, Emulators and Debugging - Objectives of Embedded Product Development Life Cycle - Different Phases of EDLC - EDLC Approaches - Trends in Embedded Industry - Case Study: Digital Clock.

Text Book

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

Reference Books

1. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, TMH. Second Edition 2009
2. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley. Third Edition 2006
3. Cliff Young, Faraboschi Paolo, and Joseph A. Fisher, "Embedded Computing: A VLIW Approach to Architecture, Compilers and Tools", Morgan Kaufmann Publishers, An imprint of Elsevier, 2005.
4. David E. Simon, “An Embedded Software Primer” Pearson Education, 1999.

Web Resources

1. https://www.tutorialspoint.com/embedded_systems/embedded_systems_tutorial.pdf
2. https://www.bharathuniv.ac.in/
3. https://www.iitg.ac.in/
4. https://sushmatoravi.files.wordpress.com/2017/08/233633895-intro-to-embedded-systems-by-shibu-kv.pdf

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Acquire knowledge about microcontrollers embedded processors and their applications.	**K1**
CO2	Understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.	**K2**
CO3	Apply key concepts of embedded systems like interrupts interaction, drivers, and ports with peripheral devices.	**K3**
CO4	Analyze the design concept of embedded systems	**K4**
CO5	Design real time embedded systems using the concepts of RTOS	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	S	S	S
CO2	M	M	S	S	S	S
CO3	S	S	S	S	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – III	**Course Code:** 21PCS3E07		**Course Title:** Bio-Informatics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

1. To introduce concepts and data representations in bioinformatics
2. To develop required tools that aid in the analysis of biological data.
3. To introduce fundamentals of Sequence alignment and Gene Recognition
4. To discuss predictive methods and Protein Sequences

UNIT – I

Introduction: Bioinformatics: The Big Picture – Hemoglobin - Bioinformatics and Genomics - Access to Sequence Data and Literature Information: Introduction to Biological Databases, GenBank: Database of Most Known Nucleotide and Protein Sequences, Amount of Sequence Data, Organisms in GenBank, Types of Data in GenBank, Genomic DNA Databases, cDNA Databases Corresponding to Expressed Genes.

UNIT – II

Pairwise Sequence Alignment: Introduction - Definitions: Homology, Similarity, Identity – Gaps - Pairwise Alignment, Homology, and Evolution of Life - Scoring Matrices - Dayhoff Model: Accepted Point Mutations - PAM1 Matrix - PAM and Other PAM Matrices - Important Alternative to PAM - Alignment Algorithms.

UNIT – III

Basic Local Alignment Search Tool (BLAST): Introduction - BLAST Search Steps - BLAST Algorithm Parts: List, Scan, Extend - BLAST Algorithm: Local Alignment Search Statistics and E-Value - BLAST Search Strategies - Principles of BLAST Searching.

UNIT – IV

Advanced Database Searching: Introduction - Specialized BLAST Sites - Organism-Specific BLAST Sites - Ensembl BLAST - Specialized BLAST-Related Algorithms - Finding Distantly Related Proteins: Position-Specific Iterated BLAST (PSI-BLAST) - Assessing

Performance of PSI-BLAST. Multiple Sequence Alignment: Introduction - Definition of Multiple Sequence Alignment - Typical Uses and Practical Strategies of Multiple Sequence Alignment.

UNIT – V

Gene Expression: Microarray Data Analysis – Introduction - Microarray Data Analysis Software and Data Sets - Reproducibility of Microarray Experiments - Microarray Data Analysis: Preprocessing - Scatter Plots and MA Plots - Global and Local Normalization - Accuracy and Precision - Robust Multiarray Analysis (RMA) - Microarray Data Analysis: Inferential Statistics - Expression Ratios - Hypothesis Testing.

Text Book

1. Jonathan Pevsner, Bioinformatics and Functional Genomics, 3rd Edition,

Reference Books

1. S C Rastogi, N Mendiratta and P Rastogi, " Bioinformatics: Methods and Applications" , ISBN : 978-81-203-4785-4, published by PHI Learning Private Limited, New Delhi,2015.
2. D E Krane and M L Raymer, Fundamental Concepts of Bioinformatics, ISBN 978-81-7758-757-9, Pearson Education, 2006.
3. Andreas D.Baxevanis, B F Francis Ouellette, "Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins", Third Edition, 2005-2006, ISBN: 978-81-265-2192-0, published by John Wiley & Sons INC. , U.K.
4. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT press, 2004.

Web Resources

1. https://libguides.wpi.edu/c.php?g=355423&p=2396845
2. https://spdbv.vital-it.ch/TheMolecularLevel/Matics/

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Interpret the concepts of bioinformatics.	**K1 & K2**
CO2	Identify different types of biological sequence.	**K2**
CO3	Understanding BLAST.	**K2**
CO4	Analyse multiple sequences and find conserved regions.	**K3**
CO5	Analyse genomic sequences and identify encoded gene regions	**K3**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	S	S	S
CO2	M	M	S	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – III	**Course Code:** 21PCS3E08		**Course Title:** Theory of Computation	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

1. The learning objectives of this course are to introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
2. To enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

UNIT – I

Introduction to formal Proof – Additional Forms of Proof – Inductive Proofs – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions.

UNIT – II

Regular Expression – FA and Regular Expressions – Proving Languages not to be Regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata.

UNIT – III

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG – Deterministic Pushdown Automata.

UNIT – IV

Normal forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM. A language that is not Recursively Enumerable (RE).

UNIT – V

An Undecidable problem RE – Undecidable Problems about Turing Machine – Post's Correspondence Problem – The classes P and NP.

Text Books

1. Peter Linz, "An Introduction to Formal Languages and Automata", Third Edition ,Narosa, 2005
2. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education, 2007.

Reference Books

1. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.
2. Thomas A. Sudkamp," An Introduction to the Theory of Computer Science,Languages and Machines", Third Edition, Pearson Education, 2007.
3. Raymond Greenlaw an H.James Hoover, " Fundamentals of Theory of Computation, Principles and Practice", Morgan Kaufmann Publishers, 1998.
4. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.
5. J. Martin, "Introduction to Languages and the Theory of computation," Third Edition, Tata Mc Graw Hill, 2007.

Web Resources

1. https://www.tutorialspoint.com/automata_theory/index.htm
2. avatpoint.com/theory-of-automata
3. https://cs.stanford.edu/people/eroberts/courses/soco/projects/2004-05/automata-theory/basics.html

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Analyse and design finite automata	**K1**
CO2	Demonstrate their the understanding of key notions	**K2**
CO3	Prove the basic results of the Theory of Computation	**K3**
CO4	Analyze the Context-Free Grammar and its Normal Forms	**K3**
CO5	Understanding undecidable problem	**K3**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	M	M	S	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	S	S	S
CO5	S	S	S	M	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – III	**Course Code:** 21PCS3E09		**Course Title:** Cloud Computing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

1. The objective of this course is to provide students with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications
2. Understand Cloud Computing fundamental issues, technologies, applications and implementations.
3. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

UNIT – I

INTRODUCTION, CONCEPT AND TECHNOLOGIES: – Introduction - Cloud Models – Cloud Service Examples - Cloud Based Services & Applications - Cloud concepts and Technologies: Virtualization – Load Balancing – Scalability & Elasticity – Deployment - Replication.

UNIT – II

CLOUD SERVICES AND PLATFORMS: 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 – Apache Hadoop – Hadoop Map Reduce Job Execution – Hadoop Schedulers – Hadoop Cluster Setup.

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.

Text Books

1. ArshdeepBahga, Vijay Madisetti, "Cloud Computing: A Hands – On Approach" Universities press (India) Pvt. limited 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 edition, 2008.
3. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile,Security and More, Jones & Bartlett Learning, 2012.

Web Resources

1. https://www.tutorialspoint.com/cloud_computing/index.htm
2. https://www.javatpoint.com/cloud-computing-tutorial
3. https://www.guru99.com/cloud-computing-for-beginners.html

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To understand the basic knowledge about the cloud computing techniques and architecture.	**K1**
CO2	To learn the presents cloud computing collaborations and applications.	**K2**
CO3	To impart the new concept of various virtualization in cloud computing	**K3**
CO4	To gain knowledge of cloud services and cloud security	**K4**
CO5	Apply Cloud in various Real-time Applications	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	S	S	S
CO2	S	M	S	S	S	M
CO3	S	S	S	S	S	S
CO4	S	S	S	M	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – IV	**Course Code:** 21PCS4E10		**Course Title:** Mobile Computing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	8	120	4	100

Course Objectives

1. Understand the basic concepts of mobile.
2. Be familiar with GPRS Technology.
3. system Be exposed to Ad-Hoc networks.
4. Gain knowledge about different mobile platforms and application development

UNIT – I

Basics of mobile - Mobile Device Profiles - Middleware and Gateways - Wireless Internet - Smart Clients - Three-tier Architecture- Design Considerations for Mobile Computing– Mobility and Location Based Services.

UNIT – II

Mobile Computing through Internet - Mobile-enabled Applications - Developing Mobile GUIs – VUIs and Mobile Applications – Characteristics and Benefits -Multichannel and Multi-modal User Interfaces – Synchronization and Replication of Mobile Data - SMS Architecture – GPRS – Mobile Computing through Telephony.

UNIT – III

Mobile Application Development - Android- wi-fi –GPS – Camera – Movement – Orientation - Event Based Programming – iOS/ windows CE - Blackberry – Windows Phone – M-Commerce- Structure – Pros & Cons – Mobile Payment System - J2ME

UNIT – IV

ADHOC Wireless Network - Ad Hoc Wireless Network –MAC Protocol – Routing Protocols - Transport Layer Protocol - QoS – Energy Management – Application Design – Workflow – Composing Applications – Dynamic Linking – Intents and Services – Communication via the Web.

UNIT – V

Security and Hacking - Password Security – Network Security – Web Security – Database Security - Wireless Sensor Network - Architecture and Design – Medium Access Control – Routing – Transport Layer – Energy Model.

Text Books

1. Jochen Schiller, Mobile Communications, Second Edition,2012.
2. William Stallings,"Wireless Communications & Networks", Pearson Education, 2009.

Reference Books

1. C.Siva Ram Murthy, B.S. Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", 2nd Edition, Pearson Education. 2004
2. Ashok K Talukder, Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill, 2005.
3. Jochen Burkhardt Dr.Horst Henn, Klaus Rintdoff,Thomas Schack, "Pervasive Computing", Pearson, 2009.
4. Fei Hu , Xiaojun Cao, " Wireless Sensor Networks Principles and Practice " CRC Press, 2010.

Web Resources

1. https://www.tutorialspoint.com/mobile_computing/index.htm
2. https://www.javatpoint.com/mobile-communication-tutorial
3. https://www.simplilearn.com/mobile-technology-platforms-applications-tutorial-video

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Able to explain the basics of mobile system	**K1**
CO2	Able to develop mobile application	**K2**
CO3	Understand the Mobile Ad hoc networks and its routing	**K3**
CO4	Understand the different types of security features	**K4**
CO5	Apply all techniques used in the GSM and GPRS	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	M
CO3	S	S	S	S	S	S
CO4	S	S	S	M	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – IV	**Course Code:** 21PCS4E11		**Course Title:** Soft Computing	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	8	120	4	100

Course Objectives

1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective.

UNIT – I

Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics - Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope - Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch-Pitts Model – Hebb Network – Linear Separability.

UNIT – II

Supervised Learning Networks: Perceptron Networks – Adaline and Madaline Networks – Back Propagation Network – Radial Basis Function Network. Associative Memory Networks – BAM - Hopfield Network - Boltzmann Machine. Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network.

UNIT – III

Fuzzy Sets: Basic Concept – Crisp Set Vs Fuzzy Set - Operations on Fuzzy Set – Properties of Fuzzy Sets – Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation - Membership Functions: Features – Fuzzification – Methods of Membership Value Assignments – Defuzzification – Methods.

UNIT – IV

Fuzzy Arithmetic – Extension Principle – Fuzzy Measures – Fuzzy Rules and Fuzzy Reasoning: Fuzzy Propositions – Formation of Rules – Decomposition of Rules – Aggregation of Rules – Approximate Reasoning – Fuzzy Inference and Expert Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT – V

Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

Text Book

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

Reference Books

1. S. Rajasekaran, G.A.V. Pai, "Neural Networks, Fuzzy Logic, Genetic Algorithms", Prentice Hall India, 2004.

Web Resources

1. https://www.springer.com/journal/500
2. https://www.sciencedirect.com/science/article/pii/S1877050916325467
3. https://www.tutorialspoint.com/fuzzy_logic/index.htm
4. http://digitalthinkerhelp.com/what-is-soft-computing-and-its-applications-and-techniques/

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.	**K1**
CO2	Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic	**K2**
CO3	To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.	**K3**
CO4	Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.	**K4**
CO5	Reveal different applications of these models to solve engineering and other problems.	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	M	M	S	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	S	M	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – IV	**Course Code:** 21PCS4E12		**Course Title:** Principles of Information Security	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	8	120	4	100

Course Objectives

1. To introduce fundamental concepts of security.
2. To introduce and discuss the relevance of security in operating system, web services.
3. To introduce fundamental concepts of secure electronic transactions.

UNIT – I

Introduction: Overview of Computer Security, Security Concepts, Need of Security- Threats- Deliberate Software Attacks, Deviation in Quality of Service, Attacks- Malicious Code, Brute Force, Timing Attack, Sniffers Access Control Mechanisms - Access Control, Access Control Matrix, Access Control in OS-Discretionary and Mandatory Access Control, Role-Based Access Control, Case Study SELinux.

UNIT – II

Security Policies and Models: Confidentiality Policies, BellLaPadula Model, Integrity Policies, Biba Model, Clark-Wilson Models, Chinese Wall Model, Waterfall Model.

UNIT – III

Software Vulnerabilities: Buffer and Stack Overflow, Crosssite Scripting(XSS) , and Vulnerabilities, SQL Injection and Vulnerabilities , Phishing. **Malware**: Viruses, Worms and Trojans. Topological Worms. Internet Propagation Models for Worms.

UNIT – IV

Security in Current Domains: Wireless LAN security - WEP Details. Wireless LAN Vulnerabilities – Frame Spoofing. Cellphone Security - GSM and UMTS Security. Mobile Malware - Bluetooth Security Issues.

UNIT – V

Secure Electronics Transactions: Framework, Strength and Weakness, Security in Current Applications : Online Banking , Credit Card Payment Systems. Web Services Security: XML, SOAP, SAML, RFID.

Text Books

1. Bernard Menezes, Network security and Cryptography, Cengage Learning India, 2010.
2. M Bishop, Computer Security: Art and Science, Pearson Education, 2003.

Reference Books

1. E Whiteman and J Mattord, Principles of information security 4th edn, Cengage Learning
2. V K Pachghare, Cryptography and information security, PHI
3. Behrousz A Forouzan, D Mukhopadhyay, Cryptography and network Security, McGraw Hill
4. W Mao, Modern Cryptography: Theory & Practice, Pearson Education, 2004.
5. C P. Fleeger and S L Fleeger, Security in Computing, 3/e, Pearson Education, 2003.

Web Resources

1. https://en.wikipedia.org/wiki/Information_security
2. https://www.csoonline.com/article/3513899/what-is-information-security-definition-principles-and-jobs.html
3. https://www.geeksforgeeks.org/what-is-information-security/

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Appreciate the common threats faced today	**K1**
CO2	Interpret the foundational theory behind information security	**K2**
CO3	Design a secure system	**K3**
CO4	Identify the potential vulnerabilities in software	**K4**
CO5	Appreciate the relevance of security in various domain.	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	M

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – V	**Course Code:** 21PCS4E13		**Course Title:** Social Network Analysis	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	8	120	4	100

Course Objectives

1. To understand the components of the social network.
2. To model and visualize the social network.
3. To mine the users in the social network.
4. To understand the evolution of the social network.
5. To know the applications in real time systems.

UNIT – I

Introduction to Web - Limitations of Current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and Measures in Network Analysis - Discussion Networks – Blogs and Online Communities – Web Based Networks.

UNIT – II

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and Aggregating Social Network Data – Random Walks and their Applications –Use of Hadoop and Map Reduce – Ontological Representation of Social Individuals Relationships.

UNIT – III

Aggregating and Reasoning with Social Network Data, Advanced Representations – Extracting Evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms – Node Node Classification in Social Networks.

UNIT – IV

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models – Probabilistic Relational Models.

UNIT – V

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

Text Books

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, —Computational Social Network Analysis: Trends, Tools and Research Advance, Springer, 2012
2. Borko Furht, —Handbook of Social Network Technologies and Applications, Springer, 1st edition, 2011Charu C. Aggarwal, —Social Network Data Analytics, Springer; 2014.

Reference Books

1. Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysis, Springer, 2010.
2. Guandong Xu , Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications, Springer, 1st edition, 2012
3. Peter Mika, —Social Networks and the Semantic Web, Springer, 1st edition, 2007.

Web Resources

1. http://www.orgnet.com/sna.html
2. https://www.sciencedirect.com/topics/social-sciences/social-network-analysis
3. https://www.slideshare.net/gcheliotis/social-network-analysis-3273045

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Ability to work on the internals components of the social network	K1
CO2	Learn to model and visualize the social network	K2
CO3	Learn to mine the behaviour of the users in the social network	K3
CO4	Enable to predict the possible next outcome of the social network	K4
CO5	Apply social network in real time applications	K6

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	S	S	S
CO2	M	M	S	S	S	S
CO3	S	S	S	S	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – V	**Course Code:** 21PCS4E14		**Course Title**: Professional Ethics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	8	120	4	100

Course Objectives

To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT – I

HUMAN VALUES: Morals, Values and Ethics – Integrity – Work ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Cooperation – Commitment – Empathy – Self-Confidence – Character – Spirituality – Introduction to Yoga and Meditation for Professional Excellence and Stress Management.

UNIT – II

ENGINEERING ETHICS: Senses of Engineering Ethics‟ – Variety of Moral Issues – Types of Inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg‟s Theory – Gilligan‟s Theory – Consensus and Controversy – Models of Professional Roles – Theories about Right Action – Self-Interest – Customs and Religion – Uses of Ethical Theories.

UNIT – III

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as Experimentation – Engineers as Responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT – IV

SAFETY, RESPONSIBILITIES AND RIGHTS: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT – V

GLOBAL ISSUES : Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

Text Books

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

Reference Books

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011.

Web Resources

1. https://www.slideshare.net/nandakumar75491/professional-ethics-in-engineering
2. www.onlineethics.org
3. www.nspe.org
4. www.globalethics.org
5. www.ethics.org

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understanding the fundamentals concept of professional ethics.	**K1, K2**
CO2	Learn about Engineerning Ethics	**K2**
CO3	Apply ethics in society, discuss the ethical issues related to engineering.	**K3 & K5**
CO4	Realize the responsibilities and rights in the society	**K4**
CO5	Enable to create awareness on Safety, Responsibilities and Rights of Professinalists.	**K6**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	S	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Elective – V	**Course Code:** 21PCS4E15		**Course Title**: Block Chain Technology	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	8	120	4	100

Course Objectives

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work
2. To securely interact with them
3. Design, build, and deploy smart contracts and distributed applications
4. Integrate ideas from blockchain technology into their own projects.

UNIT – I

Basics: Distributed Database, Two General Problem, Byzantine General Problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC Resistance, Turing Complete. Cryptography: Hash Function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT – II

Blockchain:Introduction, Advantage over Conventional Distributed Database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain Application, Soft & Hard Fork, Private and Public Blockchain.

UNIT – III

Distributed Consensus: Nakamoto Consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy Utilization and Alternate.

UNIT – IV

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining Strategy and Rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

UNIT – V

Cryptocurrency Regulation: Stakeholders, Roots of Bit Coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain.

Text Book

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper, 2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Web Resources

1. https://www.guru99.com/blockchain-tutorial.html
2. https://www.simplilearn.com/blockchain-tutorial-article
3. https://www.javatpoint.com/blockchain-tutorial

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Design principles of Bitcoin, Ethereum and Simplified Payment Verification protocol.	**K1**
CO2	List and describe differences between proof-of-work and proof-of-stake consensus.	**K2**
CO3	Interact with a blockchain system by sending and reading transactions.	**K3**
CO4	Design, build, and deploy a distributed application.	**K4**
CO5	Evaluate security, privacy, and efficiency of a given blockchain	**K6**

	system.	

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	S	M	S	S	M
CO3	S	S	S	S	S	S
CO4	S	S	S	S	M	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
Project	**Course Code:** 21PCS4PR02		**Course Title**: Dissertation and Viva-Voce	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	14	210	6	100

Course Objectives

1. To develop real time applications.
2. To implement the concepts of Software Project Management.
3. To teach students in applying skills and tools to manage and develop a solution.

Course Outcomes (COs)

On Successful completion of the course the students will have demonstrated

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the concept and challenges of market.	**K1**
CO2	Collect, manage ,plan and develop a real time application	**K2**
CO3	Gain hands-on experience on different project models	**K3**
CO4	Helps to understand the complexity and maintaining quality.	**K4**
CO5	Prepare documentation	**K4**

K1- Remember, K2- Understand, K3-Analyse, K4- Implement, K5-Evaluate, K6-Create

Mapping of COs with Pos

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	M	S	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	M	S	S
CO5	S	S	S	S	S	S

S – Strong, M – Medium, L – Low

EDC-EXTRA DISCIPLINARY COURSE

Program: M.Sc Computer Science				
EDC	**Course Code:** 21PCS2EDC1		**Course Title:** Principles of Information Technology	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

To acquire skills relating to IT basics, computer applications, programming, interactive medias, Internet basics etc.

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 – Strategic Hardware Issues. 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 Datamodels – Data Warehouses – Telecommunications and Networks: The Telecommunication System – Networks – Telecommunications Applications – 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.

Text Book

1. Turban, Rainer, Potter "Introduction to Information Technology," 2nd edition, Wiley India, 2007

Reference Book

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

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand fundamental concepts and techniques of Information technology.	K1 & K2
CO2	Have a basic understanding of personal computers and their operations.	K2 & K3
CO3	Learn about computer Hardware	K4
CO4	Implementing Ethics, Impacts and Security of IT	K5 & K6
CO5	Be able to identify issues related to information security	K6

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

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	S	S	S
CO2	M	M	S	S	S	S
CO3	S	S	M	S	S	M
CO4	S	S	S	S	S	S
CO5	S	S	S	M	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
EDC	**Course Code:** 21PCS2EDC2		**Course Title**: Fundamentals of Computers and Communications	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

1. Understanding of basic concepts of computer.
2. Learn the fundamentals of hardware, software and programming.
3. Introducing to system and application software.
4. Understanding of communication and computer security.

UNIT – I

Computer: Introduction – Components of Computers – Advantages and Disadvantages of using Computers – Computer Software – Categories of Computers -Elements of an Information Systems. The Components of the Systems Unit: Processor – Data Representation – Memory – Expansion Slot and Adapter Cards – Ports and Connectors - Buses – Bays – Power Supply – Mobile Computers and Devices.

UNIT – II

Input and Output Device: What is Input - What are Input devices – Keyboard – Pointing Device – Mouse – Other Pointing Devices – Controllers for Gaming and Media Players – Voice Input – Input for PDAs, Smart Phones and Tablet PCs- Digital Cameras – Video Input – Scanners and Reading Devices Terminals – Biometric Input - Input Devices for Physically challenged Users- Output: What is Output – Display Devices – Flat Panel Displays – CRT Monitors – Printers – Speakers, Headphones and Ear phones – Other Output Devices – Output Device for Physically Challenged Users – Storage Devices.

UNIT – III

Operating Systems and Utility Programs: System Software – Operating System – Operating System Functions – Operating System Utility Programs – Types of Operating Systems – Stand alone Operating Systems – Network Operating Systems – Embedded Operating System – Standalone Utility Programs. 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 – Other Internet Services – Netiquette. Communications and Networks: Communications – Uses of Computer Communications – Networks – Network communication Standards – Communication Software – Communication Over the Telephone Network – Communication Devices – Home Networks – 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 Multidimensional Databases – Web Databases – Database Administration. Computer Security: Computer Security Risks – Internet and Network Attacks – Unauthorized Access and Use.

Text Book

1. Gary B. Shelly, Thomas J. 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 C omputers- Today and Tomorrow”, 14th Edition, Thomson Course Technology, 2012
3. Alexis Leon, Mathew‟s Leon, “Fundamentals of Comput er Science and Communication Engineering”, Vikas Publishing House, New Delhi, 1998.

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand fundamental components and functionality of Computer.	K1 & K2
CO2	Learn about input and output devices	K2 & K3
CO3	Build knowledge of operating system concepts	K4
CO4	Understanding the concept of communication network	K5 & K6
CO5	Aware about database concepts and computer security	K6

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

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M	M	S	S	S
CO2	M	S	S	S	S	S
CO3	S	S	S	M	S	M
CO4	S	S	S	S	S	S
CO5	S	S	M	S	S	S

S – Strong, M – Medium, L – Low

Program: M.Sc Computer Science				
EDC	**Course Code:**21PCS2EDC3		**Course Title**: E-Commerce	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

1. Understanding Framework and Anatomy of E-Commerce Applications.
2. Learn the concept of Electronic payment system
3. Study about Standardization and EDI and EDI Software Implementation.

UNIT – I

Electronic Commerce- Electronic Commerce Framework-The Anatomy of Electronic Commerce Applications- Electronic Commerce 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 Consumers 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 – Commerical 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 Cu tting Edge of Businesss,” TMH Publications, 2005.

2. Agarwala, K.N, Deeksha Agarwala, "Business on the Net: What‟s and How‟s of ECommerce;" Macmillan, New Delhi.

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

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Learn the concept of e-commerce	K1 & K2
CO2	Examine some typical distributed applications	K2 & K3
CO3	Describe briefly some of the technologies that are used to support distributed applications	K4
CO4	Identifying the functionality of Electronic payment system	K5 & K6
CO5	Understand the Commercial use of Internet	K6

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

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	S	S
CO2	S	S	M	S	S	S
CO3	S	S	S	S	S	M
CO4	S	S	S	S	S	M
CO5	S	S	M	S	S	S

S – Strong, M – Medium, L – Low