

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM-CHENNAI
ACCREDITED BY NAAC WITH 'A++' GRADE

POSTGRADUATE DEGREE PROGRAMME

M.Sc., Computer Science

(1 Year for PG Degree / 2 Years for PG Degree)

CURRICULUM & SYLLABUS

REGULATION 2024

Choice Based Credit System (CBCS)

&

Learning Outcomes Based Curriculum Framework (LOCF)

Effective from the Academic Year

2024 -2025

Department of Computer Science

School of Computing Sciences

VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
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DEPARTMENT OF COMPUTER SCIENCE

VISION OF THE DEPARTMENT
Aims to provide quality education in the field of Computer science with state of art facilities and handle quality research in association with industry and other Universities to produce well trained IT professionals in Computer Science domain.

MISSION OF THE DEPARTMENT	
M1	To Provide knowledge through teaching and training in the field of Computer Science.
M2	To concentrate on teaching-learning, research, project and consultancy help to increase the growth of IT and IT Enabled Services.
M3	To train students to get best opportunities and tackle challenges in IT industry.
M4	To equip students with communication skill, Leadership quality, ability to work with team help to improve the society.
M5	To provide value based and technical oriented related students help to build the nation.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)	
PEO1	Graduates are prepared to be employed in IT industries by providing expected Domain Knowledge.
PEO2	Graduates are provided with practical training, hands-on and project experience to meet the industrial needs.
PEO3	Graduates are motivated in career and entrepreneurial skill development to become global leaders.
PEO4	Graduates are trained to demonstrate creativity, develop innovative ideas and to work in teams to accomplish a common goal.
PEO5	Graduates are addressed with social issues and guided to operate problems with Solution.

PROGRAMME OUTCOMES (PO)	
PO1	**Critical Thinking:** Apply knowledge of Computer Science to identify, analyse problems and to provide effective solution in the area of Computing.
PO2	**Computing Skills and Ethics:** Analyse a problem, and identify and define thE computing requirements appropriate to its solution.
PO3	**Analytical skill:** Ability to design, develop algorithms and provide software solutions to cater the industrial needs.
PO4	**Modern Tool Usage:** Use current techniques, skills, and tools necessary for computing practices
PO5	**Employability Skills:** Inculcate skills to excel in the fields of Information Technology and its Enabled services, Government and Private sectors, Teaching and Research.
PO6	**Ethics:** Insists ethical responsibilities, human and professional values and make their contribution to the society.
PO7	**Individual and team work:** Function effectively as an individual, and as a member or a leader in diverse team and multidisciplinary settings.
PO8	**Individual and team work:** Function effectively as an individual, and as a member or a leader in diverse team and multidisciplinary settings.

PO9	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO10	**Project management and finance:** Demonstrate knowledge and understanding of the problem and management principles and apply these to one's own work, as a member and engineering and management principles and apply these to one's own work, as a member.
PO11	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO12	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1	Professionally trained in the areas of programming, multimedia, animation, web Designing, networking and to acquire knowledge in various domain-based electives.
PSO2	Abet students to communicate effectively and to improve their competency skills to solve real time problems.
PSO3	The ability to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

BOARD OF STUDIES

List of Members

Department of Computer Science

S. No	Name & Designation	Address	Role
1.	Dr. P. Magesh Kumar	Director, School of Computing Sciences, VISTAS	Chairperson
2.	Dr. R. Ganesan	Professor and Dean, School of CSE, VIT, Chennai Campus, Vandalur, Kelambakkam, Main Road, Chennai-600127	Academic Expert (External Member)
3.	Mr.D.Rajkumar	Program Manager, Birla Soft, Prince Infocity Chennai	Industrial Expert (External Member)
4.	Dr. R. Parameswari	Professor and Head Department of Computer Science, VISTAS	Internal Member
5.	Dr. S. Perumal	Professor, Department of Computer Science, VISTAS	Internal Member
6.	Dr. G. Thailambal	Associate Professor, Department of Computer Science, VISTAS	Internal Member
7.	Dr. S. Mangaiyarkarasi	Associate Professor, Department of Computer Science, VISTAS	Internal Member
8.	Mr. R. Balamurugan	Assistant Professor, Department of Computer Science, VISTAS	Internal Member
9.	Ms. R. Padma	Assistant Professor, Department of Computer Science, VISTAS	Internal Member
10.	Mr. K. Thirumurugan	Milestone Internet Marketing Private Limited, Team Lead-DX, Chennai	Alumni Member (External Member)

CREDIT DISTRIBUTION

M.Sc., Computer Science

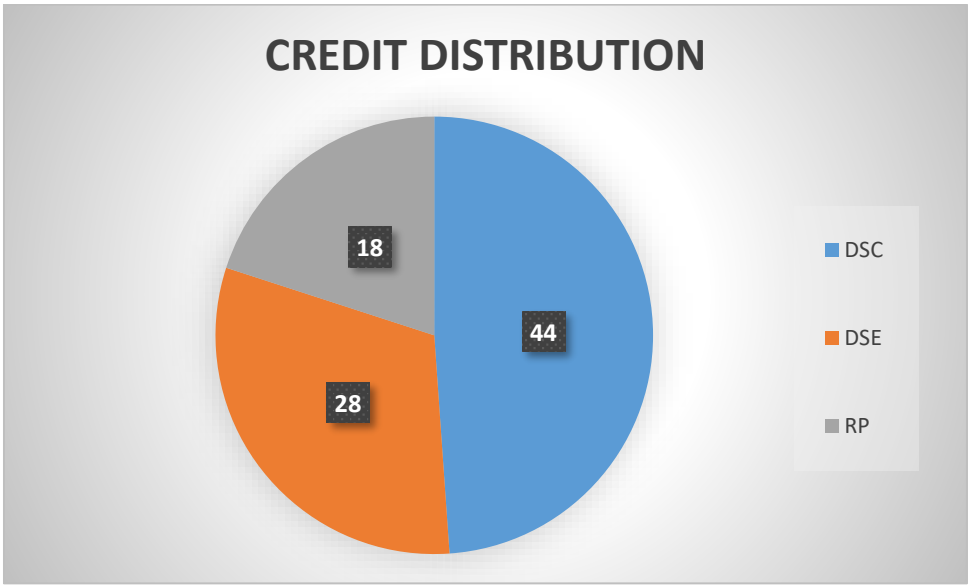
Minimum credits to be earned: 90

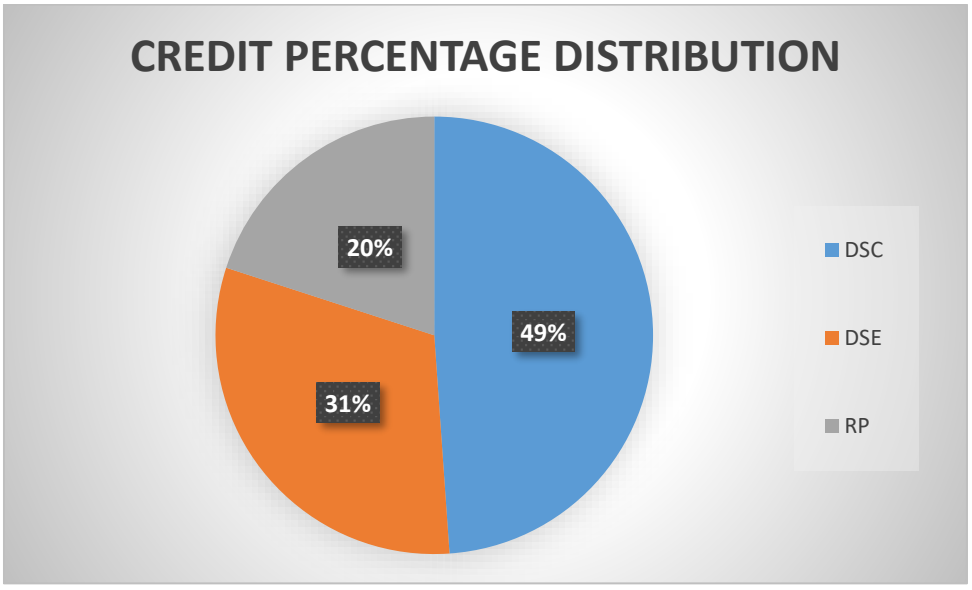
(1 Year for PG Degree / 2 Years for PG Degree)

Component	I Sem	II Sem	III Sem	IV Sem	2 Yrs. Total Credits
DSC	16	10	14	5	45
DSE	8	8	8	3	27
RP	-	4	2	12	18
Total Credits	24	22	24	20	90

ABBREVIATIONS:

DSC	Disciplinary Specific Core
DSE	Disciplinary Specific Elective
RP	Research Methodology, Internship, Mini Project, & Research Project


CREDIT DISTRIBUTION
18
44
28
DSC
DSE
RP


CREDIT PERCENTAGE DISTRIBUTION
20%
49%
31%
DSC
DSE
RP

CURRICULUM STRUCTURE

M.Sc., Computer Science

Total number of Credits: 90

M.Sc., Computer Science Minimum Credits to be earned :90										
SEMESTER 1										
			Hours / Week					Maximum Marks		
Category	Code	Course	L	T	P	O	C	CIA	SEE	Total
DSC 1	24CMCS11	Design and Analysis of Algorithm	3	1	0	2	4	40	60	100
DSC 2	24CMCS12	Shell Programming using Linux	4	0	0	2	4	40	60	100
DSC 3	24CMCS13	Scripting Language	4	0	0	2	4	40	60	100
DSC 2 (Lab)	24PMCS11	Linux Programming Lab	0	0	4	1	2	40	60	100
DSC 3 (Lab)	24PMCS12	Scripting Language Lab	0	0	4	1	2	40	60	100
DSE 1	24DMCS1-	DSE 1	4	0	0	2	4	40	60	100
DSE 2	24DMCS1-	DSE 2	4	0	0	2	4	40	60	100
			19	1	8	-	24	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 2										
			Hours / Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 4	24CMCS21	Advanced Database Management Systems	4	0	0	2	4	40	60	100
DSC 5	24CMCS22	Natural Language Processing	3	1	0	2	4	40	60	100
DSC 4 (Lab)	24PMCS21	Advanced Database Management Systems Lab	0	0	4	1	2	40	60	100
DSE 3	24DMCS2-	DSE 3	4	0	0	2	4	40	60	100
DSE 4	24DMCS2-	DSE 4	4	0	0	2	4	40	60	100
RP 1	24RMCS21	Research Methodology	4	0	0	2	4	40	60	100
			19	**1**	**4**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 3										
			Hours / Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 6	24CMCS31	Mobile Application Development	4	0	0	2	4	40	60	100
DSC 7	24CMCS32	Fundamentals of Data Science	3	0	0	2	3	40	60	100
DSC 8	24CMCS33	Neural Networks	3	0	0	2	3	40	60	100
DSC 6 (Lab)	24PMCS31	Mobile Application Development lab	0	0	4	0	2	40	60	100
DSC 7 (Lab)	24PMCS32	Data Science using R Lab	0	0	4	0	2	40	60	100
DSE 5	24DMCS3-	DSE 5	3	1	0	2	4	40	60	100
DSE 6	24DMCS3-	DSE 6	3	1	0	2	4	40	60	100
RP 2	24RMCS31	Internship	0	0	0	12	2	-	100	100
			16	**2**	**8**	**-**	**24**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 4										
			Hours / Week					Maximum Marks		
Category	Code	Course	L	T	P	O	C	CIA	SEE	Total
DSC 9	24CMCS41	Advanced Compiler Design	3	0	0	2	3	40	60	100
DSE 7	24DMCS4-	DSE 7	3	0	0	2	3	40	60	100
RP 3	24RMCS41	Research Project	-	-	12	10	12	40	60	100
DSC 10	24PMCS41	Data Visualization Lab	0	0	2	2	1	40	60	100
			6	2	12	-	20	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

*L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study

DISCIPLINARY SPECIFIC CORE COURSES

Category	Code	Course	L	T	P	O	C
DSC 1	24CMCS11	Design and Analysis of Algorithm	3	1	0	2	4
DSC 2	24CMCS12	Shell Programming using Linux	4	0	0	2	4
DSC 3	24CMCS13	Scripting Language	4	0	0	2	4
DSC 2 (Lab)	24PMCS11	Linux Programming Lab	0	0	4	0	2
DSC 3 (Lab)	24PMCS12	Scripting Language Lab	0	0	4	0	2
DSC 4	24CMCS21	Advanced Database Management Systems	4	0	0	2	4
DSC 5	24CMCS22	Natural Language Processing	3	1	0	2	4
DSC 4 (Lab)	24PMCS21	Advanced Database Management Systems Lab	0	0	4	0	2

DSC 6	24CMCS31	Mobile Application Development	4	0	0	2	4
DSC 7	24CMCS32	Fundamentals of Data Science	3	0	0	2	3
DSC 8	24CMCS33	Neural Networks	3	0	0	2	3
DSC 6 (Lab)	24PMCS31	Mobile Application Development lab	0	0	4	0	2
DSC 7 (Lab)	24PMCS32	Data Science using R Lab	0	0	4	0	2
DSC 9	24CMCS41	Advanced Compiler Design	3	1	0	2	4
DSC 10	24PMCS41	Data Visualization Lab	0	0	2	2	1

DISCIPLINARY SPECIFIC ELECTIVE COURSES

Category	Code	Course	L	T	P	O	C
DSE 1	24DMCS11	Mobile Computing	4	0	0	2	4
	24DMCS12	Big Data Analytics	4	0	0	2	4
DSE 2	24DMCS13	Cloud Computing	4	0	0	2	4
	24DMCS14	Theory of Automata	4	0	0	2	4
DSE 3	24DMCS21	Theoretical Foundations of Computer Science	4	0	0	2	4
	24DMCS22	Digital Image Processing	4	0	0	2	4
DSE 4	24DMCS23	Artificial Intelligence	4	0	0	2	4
	24DMCS24	Embedded System	4	0	0	2	4
DSE 5	24DMCS31	Security Issues in Machine Learning	3	1	0	2	4

	24DMCS32	Parallel and Distributed Computing System	3	1	0	2	4
	24DMCS33	Data Mining and Data Warehousing	3	1	0	2	4
DSE 6	24DMCS34	Cryptography and its Applications	3	1	0	2	4
	24DMCS35	Block Chain Technology	3	1	0	2	4
	24DMCS36	Deep Learning and Neural Networks	3	1	0	2	4
DSE 7	24DMCS41	Cyber Security	3	0	0	2	3
	24DMCS42	Advanced Networks	3	0	0	2	3
	24DMCS43	R Programming	3	0	0	2	3

RESEARCH PROJECT

Category	Code	Course	L	T	P	O	C
RP 1	24RMCS21	Research Methodology	4	0	0	2	4
RP 2	24RMCS31	Internship	0	0	0	12	2
RP 3	24RMCS41	Research Project	0	0	12	10	12

SEMESTER I

24CMCS11 DESIGN AND ANALYSIS OF ALGORITHM

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES:

This course gives insight into the design and analysis for divide and conquer, sorting, dynamic programming, backtracking, Dynamic Programming, knapsack, tree vertex splitting, and bi-connected problems.

UNIT-I: INTRODUCTION 12

Algorithm, pseudo code for expressing algorithms, performance analysis-space complexity, time complexity, asymptotic notation- big (O) notation, omega notation, theta notation and little (o) notation, recurrences, probabilistic analysis, disjoint set operations, union and find algorithms.

UNIT- II: DIVIDE & CONQUER ANDGREEDY METHOD 12

General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs. GREEDY METHOD: General method, Applications-job sequencing with deadlines, Fractional knapsack problem, minimum cost spanning trees, Single source shortest path problem.

UNIT- III: DYNAMIC PROGRAMMING 12

DYNAMIC PROGRAMMING: General method, applications - optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT- IV: BASIC TRAVERSAL AND SEARCH TECHNIQUES 12

Techniques for Binary Trees –Techniques for Graphs-Connected Components and Spanning Trees-Biconnected Components and DFS. Backtracking: General Method-8-Queen Problem, Sum of Subsets Graph Coloring : Hamiltonian Cycle.

UNIT- V: BRANCH AND BOUND 12

The Method-0/1 Knapsack Problem. NP-Hard And NP - Complete Problem - Basic Concepts - Cook’s Theorem -NP - HARD GRAPH Problems - Clique Decision Problem - Chromatic Number Decision Problem NP - HARD

Scheduling Problems - Flow Shop Scheduling - Job shop scheduling: The Method-0/1 Knapsack Problem-Traveling Salesman Problem**.**

Total: 60 Hours

COURSE OUTCOMES:

At the End of the course, the Student will be able to:

CO-1: Analyze the Complexity and performance of algorithms.

CO-2: Analyze Quick sort, Merge sort algorithm, BFS and DFS Algorithms.

CO-3: Apply appropriate algorithm design techniques for solving problems.

CO-4: Understand how the choice of data structures and the algorithm design methods impact the performance of programs**.**

CO-5: Understand the set of rules design methods in the Greedy Method.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran (2013) "Fundamentals of Computer Algorithms", Second Edition, University Press.

Reference Books:

1. Manas Ranjan Kabat (2013), "Design And Analysis Of Algorithms", PHI Learning Pvt. Ltd.

2. Jean-Paul Trembley, Paul.G.Sorenson (2010),"Introduction to Data structures with Applications", Tata McGraw Hill, and Second Edition,.

3. G. Brassard and P. Bratley (1997), " Fundamentals of Algorithms", PHI, New Delhi

4. M.A.Weiss, (2013), "Data Structures and algorithm Analysis in C++", Pearson Education, Asia.

5.Sandeep Sen and Amit Kumar (2019**), "**Design and Analysis of Algorithms: A contemporary perspective", Cambridge University Press,

Web Sources:

1. www.guru99.com
2. www.youtube.com/watch?v=D6Q_wHrzxDs

24CMCS12 **SHELL PROGRAMMING USING LINUX**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To familiarize students with the Linux environment, to learn the fundamentals of shell scripting/programming, to manage basic Linux administration, to explain execution procedure, debugging and kernel structure.

UNIT-I: LINUX OPERATING SYSTEMS 12

Introduction – History of UNIX and Linux – System Features – Software Features – Differences between Linux and Other Operating System – hardware requirements - sources of Linux Information Linux Startup and Setup: User accounts – Accessing the Linux system – Linux Commands.

UNIT-II: THE SHELL AND FILTERS 12

The command line – Command line Editing - Creating files using the vi editor: Text editors – The vi editor – Modes of operation in vi editor–Kernal – Shell –Types of Shells-Terminal –Command Line Shell – Graphical Shells – Filters –Pipes - Shell Scripting.

UNIT-III: THE SHELL PROGRAMMING 12

Shell Programming-Shell Metacharacters - Shell Variables- Shell Scripts- Debugging Scripts – Operators - Integer Arithmetic and String Manipulation- Decision Making- Functions- I/O Redirection and Piping- Exception Handling- Creating Shell Programs for Automating Tasks - File Handling - Trapping Signals – Examples.

UNIT-IV: LINUX FILE STRUCTURE AND FILE MANAGEMENT 12

Introduction to Linux File System- file descriptors –system calls and device drivers - File structures – managing Files - File Management Operation: File and Directory Permissions - System Calls for File Management - Managing Directories - Directory API.

UNIT-V: CASE STUDY 12

Script that searches for a specific word in a file and counts its occurrences -Handle signals like Ctrl+C in a shell script - Checks for and removes duplicate lines in a text file - Generates a secure random password - Calculates the total size of all files in a directory - Finds and lists all empty files in a directory.

Total: 60 Hours

COURSE OUTCOMES:

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

CO-1: Can execute Linux commands and installation process.

CO-2: Evaluate different types of editors in Linux using for shell programming.

CO-3: Understand about shell programming concepts and Write shell scripts to automate various tasks.

CO-4: Understand about Linux File Structures and Managing files.

CO-5: Apply necessary tools and methods for Linux application development and learn about the features and techniques that are unique to Linux.

Text Books:

1. Richard Petersen (2008), "Linux: The Complete Reference", Sixth Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi

2. Neil Matthew, Richard stones, Alan Cox (2012), "Beginning Linux Programming", Wrox Publication

Reference Books:

1. NIIT (2006), "Operating System LINUX", PHI, Eastern Economy Edition

Web Sources:

1. https://www.geeksforgeeks.org/introduction-linux-shell
2. www.javatpoint.com/linux

24CMCS13 **SCRIPTING LANGUAGES**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

Students will understand Scripting languages and its purposes. The course will cover theoretical aspects of the subject with suitable programs through scheduled lectures. The course will cover the Client Side and Server-Side Scripting Languages.

UNIT-I: HTML 12

Internet Basics- Introduction to Scripting Languages- Client Side and Server Side Scripting Languages- - Introduction to HTML - List - Creating Table - Linking document - Frames - Graphics to HTML Doc - Style sheet - Style sheet basic - Add style to document - Creating Style sheet rules - Style sheet properties - Font - Text - List - Color and background color - Box - Display properties.

UNIT-II: VB SCRIPT 12

Introduction to VBScript - Adding VBScript Code to an HTML Page - VB Script Basics - VBScript Data Types - VBScript Variables - VBScript Constants -VBScript Operators – mathematical- comparison-logical - Using Conditional Statements - Looping Through Code - VBScript Procedures – type casting variables - math functions – date functions – string functions– other functions - VBScript Coding Conventions - Dictionary Object in VBScript - Err Object

UNIT-III: JAVA SCRIPT 12

Introduction to Javascript – Advantages of Javascript – Javascript syntax - Data type –Variable - Array – Operator & Expression – Looping – control structures - Constructor Function – user defined function Dialog Box.

UNIT-IV: PERL 12

Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT-V: CGI 12

CGI and Scripting languages: Introduction to CGI, Alternative Technologies, The Hypertext Transport Protocol, URLs, HTTP, Browser Requests, Server Responses, Proxies, Content Negotiation, The Common Gateway Interface, The CGI Environment, Environment Variables, CGI Output, Forms and CGI, Sending Data to the Server.

Total: 60 Hours

COURSE OUTCOMES:

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

CO-1: Create applications by using concepts like Java Script, HTML, PERL.

CO-2: Create web scraping scripts to programmatically obtain data and content from web pages

CO-3: Evaluate techniques used to create scripts for automating system administrative tasks.

CO-4: Analyze many of the modern and way cool language features that show up frequently in scripting languages

CO-5: Have understanding of server side scripting with PERL & CGI language.

Text Books:

1. Ivan Bayross (2006), "Web Enable Commercial Application Development Using HTML, DHTML, Java script, PERL and CGI", BPB Publications

2. Kathleen Kalata (2001), "Internet Programming with VBScript and JavaScript", Thomson learning

3. J.Jaworski (1999), "Mastering Java script", BPB Publications

Reference Books:

1. Powell, Thomas; Schneider, Fritz (2004), "JavaScript: The Complete Reference", TMH, 2nd edition.

2. T. A. Powell (2002), "Complete Reference HTML", Third Edition, TMH,

Web Sources:

1. www.geeksforseeks.com

2. www.nptel.ac.in

24PMCS11 **LINUX PROGRAMMING LAB**

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

This course gives practical training in Linux programming to perform the various commands in shell script. It gives hands on training in File operations in C Programming.

1. Write a shell script to perform the file operations using Linux commands.
2. Write a shell script to perform the operations of basic Linux utilities.
3. Write a shell script to perform nCr calculation using recursion.
4. Write the shell script to find the grade of student's marks.
5. Write a Shell script to display the numbers between 1 and 9999 in words.
6. Write a Shell script for Palindrome Checking.
7. Write a shell script to find the biggest of three numbers using command line arguments.
8. Write a shell script to find the number of characters, words and lines for a given file without using the "wc"command.
9. Write a C program for implementation of system calls: a) open b) read &close c) create & write d) fork & exec
10. Write a C program for the following commands: a) cp b)mv c)delete
11. Write a C program to convert starting lowercase letter of each word into uppercase in a file.
12. Write a C program to print the contents of the file in reverse order.

Total: 30 Hours

COURSE OUTCOMES:

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

CO-1: Create basic application using Linux

CO-2: Evaluate various Linux commands

CO-3: Apply Operating system concepts using Linux.

CO-4: Apply String manipulation using Linux.

CO-5: Understand basic Linux commands

Text Books:

1. Richard Petersen (2008), “Linux: The Complete Reference”, Sixth Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi.

2. Neil Matthew, Richard stones, Alan Cox (2009) “Beginning Linux Programming”, Wrox Publication.

Reference Books:

1. NIIT (2006), “Operating System LINUX”, PHI, Eastern Economy Edition,

Web Sources:

1.www.youtube.com/watch?v=wBp0Rb-ZJak

2.www.javatpoint.com/linux

24PMCS12 **SCRIPTING LANGUAGE LAB**

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

This course gives practical training in HTML, VB script, Java script and Perl scripts to perform the various Web page designs using scripts.

1. Create a table to show your class time table using HTML.
2. Use frames such that the page is divided into 3 frames 20% on left to show contents of pages, 60% in center to show body of page, remaining on right to show remarks.
3. Create a webpage with HTML describing your department use paragraph and list tags.
4. Write a VBScript code that accepts the length, breadth and height and displays the area of a rectangle.
5. Create a form that has an email field and write VBScript code for validation of the email address.
6. Write a java script program to test the first character of a string is uppercase or not.
7. Write a java script for loop that will iterate from 0 to 15 for each iteration, it will check if the current number is odd or even, and display a message to the screen.
8. Write a java script program which computes the average marks of the 10 student's then average is used to determine the corresponding grade.
9. Write a Perl script to substitute a word, with another word in a string.
10. Write a Perl script to validate IP address and email address.
11. Write a Perl script to print the file in reverse order using command line arguments.
12. Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc

Total: 30 Hours

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO-1: Create basic application using shell scripts

CO-2: Evaluate various shell commands

CO-3: Apply Operating system concepts using shell.

CO-4: Apply String manipulation using shell.

CO-5: Understand basic shell commands

Text Books:

1. Ivan Bayross (2006), “Web Enable Commercial Application Development Using HTML, DHTML, Java script, PERL and CGI”, BPB Publications
2. Kathleen Kalata (2001), “Internet Programming with VBScript and JavaScript”, Thomson learning
3. J.Jaworski (1999), “Mastering Java script”, BPB Publications

Reference Books:

1. Powell, Thomas; Schneider, Fritz (2004), “JavaScript: The Complete Reference”, TMH, 2nd edition.
2. T. A. Powell (2002), “Complete Reference HTML”, Third Edition, TMH,

Web Sources:

1.www.geeksforseeks.com
2. www.nptel.ac.in

SEMESTER II

L	T	P	O	C
4	0	0	2	4

24CMCS21 **ADVANCED DATABASE MANAGEMENT SYSTEMS**

COURSE OBJECTIVES:

This course aims to give students in depth information about system implementation techniques, data storage, representing data elements, database system architecture, the system catalogue, query optimization, centralized DB concepts, Normalization, distributed databases and client server architecture, advanced database concepts.

UNIT-1 COMPARISON BETWEEN DIFFERENT DATABASES 12

Significance of Databases, Database System Applications, Advantages and Disadvantages of different Database Management systems, Comparison between DBMS, RDBMS, Distributed and Centralized DB.

UNIT-II RDBMS 12

Relational Query Languages, The SQL Query Language, Querying Multiple Relations, Creating Relations in SQL, Destroying and Altering Relations, Adding and Deleting Tuples, Integrity Constraints (ICs), Primary and Candidate Keys in SQL, Foreign Keys, Referential Integrity in SQL, Enforcing Referential Integrity.

UNIT- III CATEGORIES OF SQL COMMANDS 12

Data Definition, Data Manipulation Statements: SELECT - The Basic Form Subqueries, Functions, GROUP BY Feature, Updating the Database, Data Definition Facilities, Views, Embedded SQL *, Declaring Variables and Exceptions, Embedding SQL Statements, Transaction Processing, Consistency and Isolation, Atomicity and Durability, Dynamic SQL.

UNIT-IV NORMALIZATION 12

Functional Dependency, Anomalies in a Database, The normalization process: Conversion to first normal form, Conversion to second normal form, Conversion to third normal form, The boyce-code normal form(BCNF), Fourth Normal form and fifth normal form, normalization and database design, De-Normalization

UNIT-V QUERY OPTIMIZATION 12

Algorithm for Executing Query Operations: External sorting, Select operation, Join operation, PROJECT and set operation, Aggregate operations, Outer join, Heuristics in Query Optimization, Semantic Query

Optimization, Converting Query Tree to Query Evaluation Plan, multi-query optimization and application, Efficient and extensible algorithms for multi-query optimization, execution strategies for SQL sub queries, Query Processing for SQL Updates.

Total : 60 Hours

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO-1: Evaluate hierarchy of DBMS.

CO-2: Analyze different types of SQL statement.

CO-3: Apply normalization in the database & understand the internal data structure.

CO-4: Understand the transaction system & could extract data efficiently.

CO-5: Understand the notion of transaction and its ACID properties

Text Books:

1. Date C. J (2003), "An Introduction to Database Systems", Addison Wesley Longman, 8th Edition

2. Catell, R.G.G., Barry, D.K., Berler, M (2000), "The Object Data Standard: ODMG 3.0", Morgan Kaufmann,

3. Silberschatz A., Korth H., and Sudarshan S (2010), "Database System Concepts", McGraw- Hill, 6th Edition

Reference Books:

1. Charles F. Goldfarb, Paul Prescod (2004), "The XML Handbook, Prentice Hall", 5th Edition,.

2. Thomas M. Connolly, Carolyn Begg (2012),"Database Systems: Practical approach to Design, Implementation and Management", Pearson Education Limited, 6th edition,

Web Sources:

1. www.oracle-tutorial.com

2. www.studytonight.com

24CMCS22 NATURAL LANGUAGE PROCESSING

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES:

The Course provides the models, methods, and algorithms of statistical Natural Language Processing (NLP) for common NLP tasks, such as speech recognition, machine translation, spam filtering, text classification and spell checking.

UNIT I OVERVIEW AND LANGUAGE MODELLING **12** Overview - Origins and challenges of NLP-Language and Grammar-Processing Indian Languages - NLP Applications-Information Retrieval - Language Modeling: Various Grammar - based Language Models - Statistical Language Model.

UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS **12** Word Level Analysis - Regular Expressions - Finite-State Automata - Morphological Parsing - Spelling Error Detection and correction - Words and Word classes - Part-of Speech Tagging. Syntactic Analysis – Context - free Grammar - Constituency - Parsing - Probabilistic Parsing.

UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING **12** Semantic Analysis - Meaning Representation - Lexical Semantics – Ambiguity - Word Sense Disambiguation - Discourse Processing – Cohesion - Reference Resolution – Discourse Coherence and Structure.

UNIT IV NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION **12**

Natural Language Generation - Architecture of NLG Systems - Generation Tasks and Representations - Application of NLG. Machine Translation - Problems in Machine Translation - Characteristics of Indian Languages - Machine Translation Approaches - Translation involving Indian Languages.

UNIT V INFORMATION RETRIEVAL AND LEXICAL RESOURCES **12** Information Retrieval - Design features of Information Retrieval Systems – Classical - Nonclassical - Alternative Models of Information Retrieval – valuation Lexical Resources: World Net - Frame Net - Stemmers - POS Tagger - Research Corpora.

Total: 60 Hours

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO-1: Analyze experimental results and write reports for each course project to develop scientific writing skills.

CO-2: Apply core computer science concepts and algorithms, such as dynamic programming.

CO-3: Apply the methods to new NLP problems and will be able to apply the methods to problems outside NLP.

CO-4: Understand the linguistic phenomena and to explore the linguistic features relevant to each NLP task.

CO-5: Understand natural language processing and to learn how to apply basic algorithms in this field.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary (2008), "Natural Language Processing and Information retrieval", Oxford University Press

Reference Books:

1. Daniel Jurafsky and James H Martin (2008) "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall,.

2. James Allen (1995), "Natural Language Understanding", 2nd edition, Benjamin / Cummings publishing company.

Web Sources:

1. www.towardsdatascience.com/a-practitioners-guide-to-natural-language-

2. www.javatpoint.com/nlp

24PMCS21 **ADVANCED DATABASE MANAGEMENT SYSTEMS LAB**

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

The student learns to work in DDL, DML, TCL and DCL, Joins. The student will be able to create cursors, manage users.

LIST OF PROGRAMS:

1. Learning basic DDL, DML, DCL and TCL commands
2. Working with dual table.
3. Use of Joins and Subqueries.
4. Views, sequences and indexes.
5. Managing users, privileges and roles.
6. PL/SQL-Data types, control structures.
7. Creating procedures with PL/SQL.
8. Error handling in PL/SQL.
9. Cursor Management in PL/SQL.
10. Writing Programs on Packages &triggers.
11. Embedding PL/SQL in high level language.
12. Implementation of Triggers & Assertions for Bank Database.

Total: 30 Hours

COURSE OUTCOMES:

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

CO-1: Create an application to check user defined exception using PL/SQL.

CO-2: Evaluate the functionalities of trigger and cursor.

CO-3: Analyze different types of built-in function in PL/SQL.

CO-4: Apply DDL, DML and DCL statement using SQL.

CO-5: Apply various types of joins in tables.

Text Books:

1. A. Silberschatz, H. F. Korth, S.Sudharsan (2011), " Database System Concepts" ,Sixth Edition, Tata McGraw Hill

2. Ivan Bayross (2015), " SQL,PL/SQL, The programming language of Oracle", Second Revised Edition, BPB Publication.

Reference Books:

1. R.Elmasri, S.B.Navathe (2008.), " Fundamentals of Database systems, Fifth Edition, Pearson Education,

2. C. J. Date (2005), " Introduction to Database Systems", Fifth Edition, Pearson Education,.

Web Sources:

1. www.guru99.com/dbms-tutorial.html
2. www.oracletutorial.com

24RMCS21 **RESEARCH METHODOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To familiarize the students to the principles of scientific methodology in business enquiry, to develop analytical skills of business research, and to develop the skills for scientific communications.

UNIT-I INTRODUCTION 12

Meaning, objectives and motivations in research, Characteristics and limitations of research – Components of research work - Criteria of good research, Research process – Types of Research, Fundamental, Pure or Theoretical Research –Applied Research –Descriptive Research – Evaluation Research –Experimental Research – Survey Research – Qualitative Research – Quantitative Research – Historical Research.

UNIT-II RESEARCH DESIGN & LITERATURE REVIEW 12

Research Design – definition – essentials and types of research design – errors and types of errors in research design. Research problem: Selecting and analyzing the research problem – problem statement formulation – formulation of hypothesis. Literature review: purpose, sources, and importance - literature review procedure. Objectives: Learning Objectives; Definitions; Formulation of the research objectives.

UNIT-III MEASUREMENT. SCALING AND SAMPLING 12

Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument. Data Collection methods – primary and secondary data – Construction of questionnaire and instrument – validation of instruments. Sample size determination - Sample design and sampling techniques.

UNIT- IV DATA ANALYSIS AND TOOLS 12

Processing of Data: Editing of Data – Coding of Data – Classification of Data – Statistical Series. Qualitative vs Quantitative data analyses – Univariate, Bivariate and Multivariate statistical techniques Measures of Central Tendency, Dispersion, correlation and Regression, Chi-square test: Applications, Steps, characteristics, limitations, Analysis of Variance and Covariance, Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Conjoint Analysis - Application of statistical software for data analysis.

UNIT V RESEARCH REPORT WRITING 12

Research report – Different types – Contents of report –executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – Ethical issues in research: Code of Ethics in Research – Ethics and Research -Process – Importance of Ethics in Research.

Total: 60 Hours

COURSE OUTCOMES:

On Completion of this course, the students can able to

CO-1: Demonstrate knowledge of research processes (reading, evaluating, and developing);

CO-2: Perform literature reviews using print and online databases;

CO-3: Employ American Psychological Association (APA) formats for citations of print and electronic materials;

CO-4: Identify, explain, compare, and prepare the key elements of a research proposal/report;

CO-5: Define and develop a possible HIED research interest area using specific research Designs.

Text Book:

1. Kothari, C.R. (2004), Research methodology: Methods and techniques. New Age International.
2. Cooper, D.R., Schindler, P.S. and Sun, J. (2006), Business research methods (Vol. 9). New York: McGraw-Hill Irwin.
3. Creswell, J.W. and Creswell, J.D. (2017) Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications.

Reference Books:

1. Business Research Methods- Donald Cooper & Pamela Schindler, TMGH, 9th editions.
2. Business Research Methods- Alan Bryman & Emma Bell, Oxford University Press.

Websources:

1. https://www.geeksforgeeks.org/introduction-to-research-methodology/

SEMESTER III

21CMCS31 **MOBILE APPLICATION DEVELOPMENT**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

Understand system requirements for mobile applications, Generate suitable design using specific mobile development frameworks, Generate mobile application design, Implement the design using specific mobile development frameworks, Deploy the mobile applications in market place for distribution.

UNIT-I: INTRODUCTION 12

Mobile Applications – Characteristics and Benefits – Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Frameworks and Tools – Mobile devices Profiles.

UNIT-II: USER INTERFACE 12

Generic UI Development – VUIs and Mobile Applications – Text to Speech techniques – Designing the right UI – Multimodal and Multichannel UI – Gesture based UIs – Screen Elements and Layouts – Voice XML – Java API.

UNIT-III: APPLICATION DESIGN 12

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Dynamic Linking – Plug ins and rules of thumb for using DLLs – Concurrency and Resource Management – Look and feel.

UNIT-IV: APPLICATION DEVELOPMENT 12

Intents and Services – Storing and Retrieving data –Communication via the Web – Communication Methods(JSON)- Notification and Alarms – Graphics and Multimedia – Video Streaming-Telephony – Location based services – Map Integration -Packaging and Deployment – Designing APP across multiple devices and operating systems(Phonegap)- Security and Hacking.

UNIT-V: APPLICATION DEVELOPMENT FRAMEWORK 12

Introduction, Objectives, Introduction to Google Android, Google Android, Android Application Development, Development Framework, SDK, Eclipse, Emulator, Android AVD, Project Framework, Apple IOS, RIM Blackberry, Microsoft Windows Phone

Total: 60 Hours

COURSE OUTCOME

At the End of this course, the Student will be able to:

CO-1: Create design using JSON.

CO-2: Analyze the requirements for mobile applications.

CO-3: Understand the Develop design for mobile applications for specific requirements.

CO-4: Understand the basic Frameworks and tools used in mobile application.

CO-5: Understand the capabilities and limitations of mobile devices.

Text Books:

1. Wallace Wang (2022), Android Application Development All-in-One For Dummies, 1st Edition, Wiley, 978-1119880470 Bill Phillips.
2. Chris Stewart (2017), Android Programming: The Big Nerd Ranch Guide, 7th Edition, Big Nerd Ranch, 978-1937785772.
3. Ian Lake (2017), Android Cookbook: Problems and Solutions for Android Developers, 2nd Edition, O'Reilly Media, 978-1491904868

Reference Books:

1. Jesse Feiler (2021), iOS App Development For Dummies, 3rd Edition, Wiley, 978-1119779276.
2. David Owens, Matt Neuburg (2022), Swift Programming: The Big Nerd Ranch Guide, 7th Edition, Big Nerd Ranch, 978-1937785925.

Web sources:

1. **https://developer.android.com/develop**
2. **https://flutter.dev/**
3. **https://www.coursera.org/**

21CMCS31 **MOBILE APPLICATION DEVELOPMENT**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

Understand system requirements for mobile applications, Generate suitable design using specific mobile development frameworks, Generate mobile application design, Implement the design using specific mobile development frameworks, Deploy the mobile applications in market place for distribution.

UNIT-I: INTRODUCTION

Mobile Applications – Characteristics and Benefits – Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Frameworks and Tools – Mobile devices Profiles.

UNIT-II: USER INTERFACE

Generic UI Development – VUIs and Mobile Applications – Text to Speech techniques – Designing the right UI – Multimodal and Multichannel UI – Gesture based UIs – Screen Elements and Layouts – Voice XML – Java API.

UNIT-III: APPLICATION DESIGN

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Dynamic Linking – Plug ins and rules of thumb for using DLLs – Concurrency and Resource Management – Look and feel.

UNIT-IV: APPLICATION DEVELOPMENT

Intents and Services – Storing and Retrieving data –Communication via the Web – Communication Methods(JSON)- Notification and Alarms – Graphics and Multimedia – Video Streaming-Telephony – Location based services – Map Integration -Packaging and Deployment – Designing APP across multiple devices and operating systems(Phonegap)- Security and Hacking.

UNIT-V: APPLICATION DEVELOPMENT FRAMEWORK 12

Introduction, Objectives, Introduction to Google Android, Google Android, Android Application Development, Development Framework, SDK, Eclipse, Emulator, Android AVD, Project Framework, Apple IOS, RIM Blackberry, Microsoft Windows Phone

Total: 60 Hours

COURSE OUTCOME

At the End of this course, the Student will be able to:

CO-1: Create design using JSON.

CO-2: Analyze the requirements for mobile applications.

CO-3: Understand the Develop design for mobile applications for specific requirements.

CO-4: Understand the basic Frameworks and tools used in mobile application.

CO-5: Understand the capabilities and limitations of mobile devices.

Text Books:

4. Wallace Wang (2022), Android Application Development All-in-One For Dummies, 1st Edition, Wiley, 978-1119880470 Bill Phillips.
5. Chris Stewart (2017), Android Programming: The Big Nerd Ranch Guide, 7th Edition, Big Nerd Ranch, 978-1937785772.
6. Ian Lake (2017), Android Cookbook: Problems and Solutions for Android Developers, 2nd Edition, O'Reilly Media, 978-1491904868

Reference Books:

3. Jesse Feiler (2021), iOS App Development For Dummies, 3rd Edition, Wiley, 978-1119779276.
4. David Owens, Matt Neuburg (2022), Swift Programming: The Big Nerd Ranch Guide, 7th Edition, Big Nerd Ranch, 978-1937785925.

Web sources:

4. **https://developer.android.com/develop**
5. **https://flutter.dev/**
6. **https://www.coursera.org/**

24CMCS33 NEURAL NETWORKS

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES

Provide an understanding of the basic mathematical elements of the theory of fuzzy sets. Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories. Explain the concepts of neural networks, fuzzy logic, and genetic algorithms.

UNIT-I: BASIC LEARNING ALGORITHMS 9

Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedbackward – Learning Process: Error Correction Learning – Memory Based Learning – Hebbian Learning – Competitive Learning - Boltzmann Learning – Supervised and Unsupervised Learning – Statistical Learning Theory – Single Layer Perceptron – Perceptron Learning Algorithm – Perceptron Convergence Theorem – Least Mean Square Learning Algorithm – Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm.

UNIT-II: RADIAL FUNCTION NETWORKS & SUPPORT VECTOR MACHINES 9

Cover's Theorem on the Separability of Patterns - Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks applications: XOR Problem – Image Classification. Support Vector Machines: Optimal Hyperplane for Linearly Separable Patterns and Nonseparable Patterns – Support Vector - insensitive Loss Function – Support Vector Machine for Pattern Recognition – XOR Problem - Machines for Nonlinear Regression

UNIT-III: COMMITTEE MACHINES AND NEURO DYNAMICS SYSTEMS 9

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model(HME) – Model Selection using a Standard Decision Tree – A Priori and Post priori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model – EM Algorithm – Applications of EM Algorithm to HME Model - Dynamical Systems – Attractors and Stability – Non-linear Dynamical Systems- Lyapunov Stability – Neurodynamical Systems – The Cohen-GrossbergTheorem.

UNIT-IV: ATTRACTOR NEURAL NETWORKS 9

Associative Learning – Attractor Neural Network Associative Memory – Linear Associative Memory – Hopfield Network – Content Addressable Memory – Strange Attractors and Chaos- Error Performance of Hopfield Networks - Applications of Hopfield Networks – Simulated Annealing – Boltzmann Machine – Bidirectional Associative Memory – BAM Stability Analysis – Error Correction in BAMs - Memory Annihilation of Structured Maps in BAMS – Continuous BAMs – Adaptive BAMs – Applications.

UNIT-V: SELF ORGANIZING MAPS 9

Self-Organizing Map – Maximal Eigenvector Filtering – Sanger's Rule – Generalized Learning Law – Competitive Learning - Vector Quantization – Mexican Hat Networks - Self-organizing Feature Maps – Applications.

Total: 45 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO-1: Evaluate the Architecture of different neural networks.
CO-2: Analyze wide variety of learning algorithms.
CO-3: Apply supervised learning.
CO-4: Understand about unsupervised learning.
CO-5: Understanding limitations of various learning algorithms.

Text Books:

1. Charu C, A. (2023). Neural networks and deep learning: a textbook. Springer.
2. Gurney, K. (2018). An introduction to neural networks. CRC press.

Reference Books:

1. Nielsen, M. A. (2016). *Neural networks and deep learning* (Vol. 25). San Francisco, CA, USA: Determination press.

Web sources:

1. https://hagan.okstate.edu/NNDesign.pdf
2. http://neuralnetworksanddeeplearning.com/

24PMCS31 **MOBILE APPLICATION DEVELOPMENT LAB**

L	T	P	O	C
0	0	2	0	2

COURSE OBJECTIVE

Understand system requirements for mobile applications, Generate suitable design using specific mobile development frameworks, Generate mobile application design, Implement the design using specific mobile development frameworks, Deploy the mobile applications in marketplace for distribution.

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock.
12. Create an application to handle images and videos according to size.

Total: 30 Hours

COURSE OUTCOME

At the End of this course, the Student will be able to:

CO-1: Create design using JSON.

CO-2: Analyze the requirements for mobile applications.
CO-3: Understand the Develop design for mobile applications for specific requirements.
CO-4: Understand the basic Frameworks and tools used in mobile application.
CO-5: Understand the capabilities and limitations of mobile devices.

Text Books:

1. Wallace Wang (2022), Android Application Development All-in-One For Dummies, 1st Edition, Wiley, 978-1119880470 Bill Phillips.
2. Chris Stewart (2017), Android Programming: The Big Nerd Ranch Guide, 7th Edition, Big Nerd Ranch, 978-1937785772.
3. Ian Lake (2017), Android Cookbook: Problems and Solutions for Android Developers, 2nd Edition, O'Reilly Media, 978-1491904868

Reference Books:

1. Jesse Feiler (2021), iOS App Development For Dummies, 3rd Edition, Wiley, 978-1119779276.
2. David Owens, Matt Neuburg (2022), Swift Programming: The Big Nerd Ranch Guide, 7th Edition, Big Nerd Ranch, 978-1937785925.

Web sources:

1. **https://developer.android.com/develop**
2. **https://www.coursera.org/**

24PMCS32 **DATA SCIENCE USING R LAB**

L	T	P	O	C
0	0	4	0	2

COURSE OBJECTIVES

R Proficiency: Gain mastery of R programming, including data. Structures, control flow, functions, and packages. Data Manipulation: Learn to import, clean, transform, and tidy data using dplyr and tidyr for effective analysis. Statistical Analysis: Conduct statistical analysis, hypothesis testing, and modeling using R's statistical functions and packages. Data Visualization: Create informative and visually appealing data visualizations with ggplot2 to uncover insights and communicate findings.

1. Program to perform Data Manipulation operations
2. Program to perform data wrangling operations.
3. Program to implement data pre-processing.
4. Program to implement k-NN classification
5. Program to implement Naïve Bayes Algorithm
6. Program to implement linear and multiple regression techniques
7. Program to implement text classification using Support vector machine.
8. Program to implement decision trees and find the accuracy
9. Program to implement k-means clustering technique
10. Program to display multiple types of charts using
11. Program to implement a simple web crawler and scrapping web pages.
12. Implement problems on natural language processing - Part of Speech tagging, N-gram & smoothening and Chunking

Total : 30 Hours

COURSE OUTCOMES

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

CO1: Describe the significance of data science and understand the Data Science process.

CO2: Explain how data is collected, managed and stored for data science.

CO3: Build, and prepare data for use with a variety of statistical methods and models

CO4: Analyze Data using various Visualization techniques.

CO5: Choose contemporary models, such as machine learning, AI, techniques to solve practical problems

Text Book:

1. Jojo Moolayil, (2021),“Smarter Decisions : The Intersection of IoT and Data Science”, PACKT.

2. Cathy O’Neil and Rachel Schutt ,(2020), “Doing Data Science”, O'Reilly.

REFERENCE Book:

1. David Dietrich, Barry Heller, Beibei Yang, (2020),“Data Science and Big data Analytics”, EMC.

Web Sources:

1. https://www.coursera.org/learn/foundations-of-data-science

24RMCS31 **INTERNSHIP**

L	T	P	O	C
0	0	0	12	2

COURSE OBJECTIVES

The objective of the mini project is to help the student develop the abilityto apply theoretical and practical tools / techniques to solve real life problems related to industry academic institutions.

Students are to take up sample project development activities with the guidelines givenbelow:

1. Preparing a project - brief proposal including:
   - Problem Identification
   - Developing a model for solving the problem
   - A statement of system / process specifications proposed to be developed (Data FlowDiagram)
   - List of possible solutions including alternatives and constraints
   - Cost benefit analysis
   - Time line activities

2. A report highlighting the design finalization [based on functional requirements & standards(if any)]

3. A presentation including the following:
   - Implementation phase (Hardware / Software / both)
   - Testing & Validation of the developed system
   - Learning in the Project Consolidated report preparation.

Total: 30 Hours

COURSE OUTCOME

At the End of this Course, the Student will be able to:

CO-1: Create new project with Report:

CO-2: Evaluate project scope and Objectives.

CO-3: Analyze Software, Hardware and tools needed for the Project.

CO-4: Apply technical knowledge to solve project problem.

CO-5: Understand the implementation of Project

SEMISTER IV

24CMCS41 **ADVANCED COMPILER DESIGN**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

This course gives an insight into introduction, parsing techniques of compiler, working with syntax, grammar and semantics of programming languages proving students with an analogy to help them understand how grammar works for programming languages.

UNI-I: INTRODUCTION **12**

Introduction – Structure of a optimizing Compiler – Compiler writing tools – Basic constructs of High level programming languages – Data structures – Parameter transmission. Lexical Analysis – Role of Lexical analyzer – Finite Automata – Regular Expressions to Finite Automata – Minimizing number of states of Deterministic Finite Automaton –Implementation of Lexical analyzer in C.

UNIT-II: PARSING TECHNIQUES **12**

Parsing Techniques – Context free Grammars – Derivations and Parse trees –Ambiguity – Writing a Grammar- Eliminating Ambiguity, Left recursion, Left Factoring - Top down – Recursive Descent Parsing – Non Recursive Predictive parsing - Bottom up Parsing – Handles Pruning – Shift Reduce parsing – Operator precedence parsing.

UNIT-III: AUTOMATIC PARSING TECHNIQUES **12**

Automatic Parsing Techniques – LR parser – Canonical Collection of LR(0) items – Construction of SLR parsing tables – LR(1) sets of items construction-LALR(1) – Construction of canonical LR parsing tables- Use of Bison or YACC.

UNIT-IV: INTERMEDIATE CODE **12**

Syntax Directed Translation – Semantic action – Implementation of syntax directed translators– Intermediate code: Prefix notation, Quadruples, Triples, and Indirect triples –Methods of translation of assignment statements, Boolean expressions and Control statements - Backpatching.

UNIT-V: CODE GENERATION **12**

Symbol Tables and Code Generation: Representing information in a symbol table –Data structures for symbol table – Introduction to code optimization – Basic blocks –DAG representation – Error detection and Recovery Semantic Processing- Code generation and local code optimization.

Total: 60 Hours

COURSE OUTCOME

At the End of this course, the Student will be able to:

CO-1: To understand the introduction of compiler and phases of compiler.

CO-1: Evaluate concepts of lexical analyzer and Finite Automation.

CO-2: Analyze key concepts of context-free grammar.

CO-3: Apply different parsing techniques and construction of syntax tree.

CO-4: Understand advanced features of automatic parsing techniques specifically LR parser, SLR parser.

CO-5: Understand the concepts of construction of LR, SLR parsing table. to construct code generator.

Text Books:

1. Chattopadhyay , Santanu, (2022), " Compiler Design", Second Edition, PHI Learning Private Ltd.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman (2015), Compilers: Principles, Techniques, and Tools, Second Edition, Addison-Wesley.

Reference Books:

1. Keith D. Cooper, Linda Torczon (2022), Engineering a Compiler, 2nd Edition, Morgan Kaufmann.
2. teven S. Muchnick (2005), Advanced Compiler Design and Implementation, Edition not specified, Morgan Kaufmann Publishers

Web Sources:

1. www.nescoacademy.com
3. www.nptel.ac.in

24PMCS41 **DATA VISUALIZATION LAB**

L	T	P	O	C
0	0	2	2	1

COURSE OBJECTIVES

- To understand the need of different datasets visualization
- Can perform descriptive and inferential analysis on data sets
- Can create visualization using modern tool
- Can develop analytical products
- Identify opportunities for application of data visualization in various domains

PROGRAMS

1. Identification of different types of data on the dataset
2. Visualization of datasets in terms of Line Chat, Area Chart, Bar Chart, Pie Chart, histogram, scatterplot, violin plot etc.
3. Representation of datasets and performing various statistical operation
4. Interactive Development of dashboard
5. Creating Visualization with Tableau
6. Presenting the working of dataset with Pivot Tables and Pivot Chart
7. Making World Map interaction with D3.js and SVG
8. Analysis of Variance (ANOVA)
9. Analysis of Covariance(ANCOVA)
10. Design and development of Analytical products

Total: 15 Hours

COURSE OUTCOMES

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

CO1:Design and create data visualizations.

CO2:Conduct exploratory data analysis using visualization.

CO3:Craft visual presentations of data for effective communication.

CO4: Use knowledge of perception and cognition to evaluate visualization design alternatives.

CO5:Use JavaScript with D3.js to develop interactive visualizations for the Web.

24RMCS41 **RESEARCH PROJECT**

L	T	P	O	C
0	0	12	10	12

COURSE OBJECTIVES

The objective of the project is to help the student develop the ability to apply theoretical and practical tools / techniques to solve real life problems related to industry academic institutions and research laboratories. After the completion of this project work the student should be able to describe the Systems Development Life Cycle (SDLC) in their carried out project:

- Evaluate systems requirements.
- Evaluate a problem definition.
- Collect information to determine requirements.
- Perform and evaluate feasibility studies like cost-benefit analysis technical feasibility time feasibility and Operational feasibility for the project.
- Work on data collection methods for fact finding.
- Construct and evaluate data flow diagrams.
- Construct and evaluate data dictionaries/ decision trees/ decision table.
- Create and evaluate graphical tools as systems flow charts entity-relationship (ER) diagrams and state transition diagrams.
- Decide the S/W requirement specifications and H/W requirement specifications.
  Plan the systems design phase of the SDLC.
- Distinguish between logical and physical design requirements.
  Design and evaluate system outputs.
- Design and evaluate systems inputs.
- Design and evaluate validity checks for input data.
- Design and evaluate user interfaces for input.
- Estimate storage requirements.
- Decide and describe various data structures.
- Perform coding for the project.
- Documentation requirements and prepare documentation.
- Perform various testing techniques/strategies.
- Be able to generate various reports in project.
- Able to deploy the project on machine/Lab/Real time environment
- Brief the maintenance procedures.
- To decide the future scope and further enhancement of the system.
- Plan for appendices (if any) to be placed in support with the project report documentation.

TYPE OF PROJECT

The majority of the students are expected to work on a real-life project preferably in someindustry/ Research and Development Laboratories / Educational Institution / Software Company. Students are encouraged to work in the various areas of computer applications. However it is not mandatory for a student to work on a real-life project. The student can formulate a project problem with the help of her/his Supervisor and if approved the studentcan commence working on it.

Total: 150 Hours

COURSE OUTCOME

At the End of this Course, the Student will be able to:

CO-1: Create new project with Report.

CO-2: Evaluate project scope and Objectives.

CO-3: Analyze Software, Hardware and tools needed for the project.

CO-4: Apply technical knowledge to solve project problem.

CO-5: Understand the implementation of Project

DISCIPLINARY SPECIFIC ELECTIVE COURSES

24DMCS11 **MOBILE COMPUTING**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

This course introduces the basic concepts of mobile computing, communication systems, mobile and wireless devices, GSM – Architecture – Routing Strategies –TCP.

UNIT-I INTRODUCTION 12

Mobile and Wireless Devices – Simplified Reference Model – Need for Mobile Computing – Wireless Transmissions –Multiplexing – Spread Spectrum and Cellular Systems- Medium Access Control –Comparisons.

UNIT-II TELECOMMUNICATION SYSTEMS 12

GSM – Architecture – Sessions –Protocols – Hand Over and Security – UMTS and IMT – 2000– Satellite Systems - Types of Satellite System - Routing- Localization

UNIT-III WIRELESS LAN 12

IEEE S02.11: System Architecture-Protocol Architecture, Physical Layer, 802.11b and 802.11a– Hiper LAN: WATM, BRAN, HYPERLAN2 – Bluetooth: User Scenarios, Architecture, Radio Layer, Baseband Layer, Link Manager Protocol, L2CAP, Security, SDP– Security and Link Management.

UNIT-IV MOBILE NETWORK LAYER 12

Mobile IP – Goals – Packet Delivery – Strategies – Registration – Tunneling and Reverse Tunneling – Adhoc Networks – Routing Strategies.

UNIT-V MOBILE TRANSPORT LAYER 12

Congestion Control – Implication of TCP Improvement – Mobility – Indirect – Snooping – Mobile – Transaction oriented TCP - TCP over wireless – Performance - Case study analysis: Smart Phone Enhanced Shopping, Advances on Sensors for Health Systems.

Total: 60 Hours

COURSE OUTCOMES:

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

CO-1: Evaluate about various wireless LAN techniques.

CO-2: Analyze radio signal propagation issues and their impact on communication system performance.

CO-3: Understand about various wireless systems and standards and their basic operation cases.

CO-4: Understand the techniques of radio spectrum allocation in multi-user systems and them impact on networks capacity.

CO-5: Understand how the various signal processing and coding techniques of GSM and its Architecture.

Text Books:

1.J. Schiller (2013), "Mobile Communications", Pearson Education, Delhi, 2ndedition.

2.Hansmann, Merk, Nicklous, Stober (2004), Principles of Mobile Computing, 2nd Edition, Springer India.

Reference Books:

1. Pahalavan, Krishnamurthy (2003),Principle of wireless Networks: A unified Approach, Pearson Education, Delhi.

2. Martyn Mallick (2004) Mobile and Wireless Design Essentials, Wiley Dreamtech India Pvt. Ltd., New Delhi.

3. W.Stallings (2004), Wireless Communications and Networks, 2nd Edition, Pearson Education, Delhi.

Web Sources:

1. www.nptel.ac.in
2. www.nescoacademy.com

24DMCS12 **BIG DATA ANALYTICS**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To explore, design, and implement basic concepts of big data & analytics methodologies for analyzing structured and unstructured data with emphasis on the relationship between the Data Scientist and its application to the business needs.

UNIT-I: INTRODUCTION TO BIG DATA 12

Introduction to Big Data Platform – Challenges of Conventional Systems - Nature of Data- Evolution of Analytic Scalability - Intelligent data analysis- Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools.

UNIT-II: MINING DATA STREAMS 12

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing -Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –Real Time Analytics Platform (RTAP) Applications.

UNIT-III: ADVANCED ANALYTICS 12

Analyzing, Visualization and Exploring the Data, Statistics for Model Building and Evaluation, Advanced Analytics - K-means clustering, Association rules-Speedup, Linear Regression, Logistic Regression, Naïve Bayes, Decision Trees, Time Series Analysis, Text Analysis.

UNIT-IV: HADOOP 12

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop - Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming.

UNIT-V: FRAMEWORKS 12

Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Total: 60 Hours

COURSE OUTCOMES:

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

CO-1: Evaluate Big Data real time analytics platform applications.

CO-2: Analyze big data platform and learn intelligent data analysis and compare old and modern data analytic tool.

CO-3: Apply advanced analytics techniques to gain knowledge of latest techniques.

CO-4: Understand the data streams concepts and stream computing.

CO-5: Understand the fundamental concepts of big data platforms and know about the basic concepts of nature and evolution of big data.

Text Books:

1. Prajapati (2014), Big Data Analytics with R and Hadoop.

Reference Books:

1. Stephan Kudyba (2014), Big Data, Mining, and Analytics: Components of Strategic Decision Making,Auerbach Publications.

2. Michael Minelli, Michele Chambers, Ambiga Dhiraj (2013), Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications.

Web Sources:

1. www.intellipaat.com/blog/big-data-tutorial-for-beginners/
2. www.simplilearn.com/tutorials/data-analytics-tutorial

24DMCS13 **CLOUD COMPUTING**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

This course introduces the fundamental concepts of cloud computing, its services and Tools. Analyze the comparative advantages and disadvantages of cloud computing.

UNIT-I CLOUD COMPUTING 12

History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT- II WEB-BASED APPLICATION 12

Pros and Cons of Cloud Service Development – Types of Cloud Service Development– Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools–AmazonEc2– GoogleApp Engine – IBM Clouds.

UNIT-III CENTRALIZING E MAIL COMMUNICATIONS 12

Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists - Cloud Computing for the Community Collaborating on Group Projects and Events for the Corporation

UNIT-IV COLLABORATION ON CALENDARS SCHEDULES AND TASK MANAGEMENT 12

Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases– Storing and Sharing Files.

UNIT V COLLABORATING VIA WEB-BASEDCOMMUNICATIONTOOLS 12

Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

Total: 60 Hours

COURSE OUTCOMES:

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

CO-1: Create applications by utilizing cloud platforms.

CO-2: Evaluate cloud computing driven commercial systems such as Google Apps and Microsoft Azure.

CO-3: Analyze own organization's needs for capacity building and training in cloud related IT areas.

CO-4: Apply appropriate technologies and approaches for the related issues to cloud computing.

CO-5: Understanding the key dimensions of the challenges of cloud computing.

Text Books:

1. Michael Miller (2008), "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing.

2. Haley Beard (2008) "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited.

Reference Books:

1. Velete, Antony. T (2007), Cloud computing a practical approach, TMH, 4th Edition.

2. Jennings, Roger (2009), Cloud computing with Windows Azure platform, PHI.

Web Sources:

1. www.coursera.com
2. www.javatpoint.com

24DMCS14 **THEORY OF AUTOMATA**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To introduce concepts in automata theory and theory of computation. To identify different formal language classes and their relationships. To design grammars and recognizers for different formal languages.

UNIT – I INTRODUCTION 12

Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.

UNIT – II REGULAR EXPRESSION (RE) 12

Regular expression (RE) Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

UNIT – III CONTEXT FREE GRAMMAR (CFG) AND CONTEXT FREE LANGUAGES (CFL) 12

Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

UNIT – IV PUSH DOWN AUTOMATA (PDA) 12

Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG.

UNIT – V TURING MACHINES (TM) 12

Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

Total: 60 Hours

COURSE OUTCOMES:

CO1: Ability to relate practical problems to languages, automata, and computability

CO 2: Ability to demonstrate an increased level of mathematical sophistication

CO 3: Ability to apply mathematical and formal techniques for solving problems

CO 4: Ability to demonstrate an increased level of Automata and push down Automata

CO 5: Ability to understand and demonstrate turning machines

Text books:

1. Hopcroft and Ullman (2006) "Introduction to Automata Theory, Languages and Computation", Pearson Education, 3rd edition,

Reference Books:

1. Martin J. C (2010), "Introduction to Languages and Theory of Computations", TMH, 4th edition,

2. Peter Linz (2011) "An Introduction to Formal Language and Automata", Narosa Pub. House,

3. Papadimitriou, C. and Lewis, C. L. (1997), "Elements of the Theory of Computation", PHI.

Web Sources:

1. https://ocw.mit.edu/courses/18-404j-theory-of-computation-fall-2020/pages/syllabus/'

24DMCS21 THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To understand the relationship with mathematics to computer sciences. The basic mathematics concepts behind the development of all algorithms.

UNIT I INTRODUCTION TO DISCRETE MATHEMATICS AND SET THEORY 12

Discrete Mathematics: Introduction, Set Notations, Cardinality of Sets; Some Standard Sets; Venn Diagrams; Operations on Sets; Principle of inclusion and exclusion; Disjoint Sets; Partition; Ordered Set; Cartesian Product of Sets; Algebra of Sets, Bit vector representation of sets

UNIT II ALGEBRAIC STRUCTURES AND LOGICS 14

Binary Operations: semi-group, group; Subgroup: Cosets; Ring; Field; Boolean algebra; Binary Arithmetic, Cyclic groups, generating sets, permutation groups, Cayley's theorem, Permutations: cycle structure and sign of a permutation, normal subgroups, quotient groups, homomorphism , Proposition, Logical Operators, Tautology, Contradiction, Logical Equivalence, Tautological Implication, Converse, Inverse, and Contrapositive, Normal Forms, Arguments validity check, Predicates, Methods of Proof.

UNIT- III GRAPH THEORY 10

Different Types of Graphs, Subgraphs, Operations on Graphs, Walk, Path, and Circuit; Connected Graph, Disconnected Graph, and Components; Euler and Hamiltonian Graphs; Eulerian graphs: characterization, directed graphs, tournaments; Planar Graph; characterization of bipartite graphs; Coloring of Graphs

UNIT IV PROBABILITY 12

Basic concepts, conditional probability and independence, Bayes' formula, random variables and expectation, linearity of expectation; Discrete random variables: Bernoulli, binomial, negative binomial, geometric, poisson; Probabilistic method: Lower bound on the maximum number of Hamiltonian paths in a tournament, Chernoff bound, maximum likelihood estimate, continuous random variables: probability density function, uniform and normal random variables.

UNIT- V: APPLICATIONS 12

Entropy and error correcting codes: Entropy, noiseless coding theorem, rate of a code, noisy coding theorem for binary symmetric channel, simple examples: error correction by repetition, error detection using parity bits; Hamming codes: encoding and parity check matrices, distance, rate, linear codes, Singleton bound; Markov chains: Definition, irreducibility, aperiodicity, stationary distribution, Fundamental theorem of Markov chains (without proof), Example: Random walks on regular, undirected graphs.

Total: 60 Hours

COURSE OUTCOMES:

At the End of the course, the students will be able to:

CO1: Apply the concepts of set theory, relations and functions in the context of various fields of computer science e.g. Database, Automata, Compiler etc.

CO2: Evaluate Boolean functions and Analyze algebraic structure using the properties of Boolean algebra.

CO3: Convert formal statements to logical arguments and correlate these arguments to Boolean logic, truth tables, rules of propositional and predicate calculus.

CO4: Apply the fundamental principle of counting, combinatorics and recurrence relations to find the complex pattern and sequences in Given datasets.

CO5: Apply graph theory concepts for designing solutions of various computing problems e.g. shortest path, graph colouring, job Sequencing etc.

Text Books:

1. A First Course in Probability, by Sheldon Ross; Pearson Publications; 2019

2. Randomized algorithms by Motwani, Raghavan; Cambridge University Press; 1995

3. Rosen, K. H., Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, Tata McGraw-Hill, 2008.

Reference Books:

1. Ullman J. D. Foundations of Computer Science: C Edition, W. H. Freeman; 1994

2. Sipser, M., Introduction to the Theory of Computation, Second Edition, Thomson Course Technology, 2007.

24DMCS22 **DIGITAL IMAGE PROCESSING**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To become familiar with digital image fundamentals. To get exposed to simple image enhancement techniques in Spatial and Frequency domain. To learn concepts of degradation function and restoration techniques. To study the image segmentation and representation techniques. To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS 12

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT 12

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION 12

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV IMAGE SEGMENTATION 12

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION 12

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

Total: 60 Hours

COURSE OUTCOMES:

At the End of the course, the students will be able to:

CO1: Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.

CO2: Operate on images using the techniques of smoothing, sharpening and enhancement.

CO3: Perform the restoration concepts and filtering techniques.

CO4: Demonstrate the segmentation, features extraction, compression and recognition methods for color models.

CO5: Compress images and use tools for image recognition.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods (2018), Digital Image Processing; Pearson, Fourth Edition.

2. Anil K. Jain (2015). Fundamentals of Digital Image Processing; Pearson.

Reference Books:

1. Kenneth R. Castleman (2006), Digital Image Processing ‘, Pearson,

2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins (2011), Digital Image Processing using MATLAB ; Pearson Education, Inc.

3. D E. Dudgeon and RM. Mersereau (1990), Multidimensional Digital Signal Processing; Prentice Hall.

4. William K. Pratt (2002), Digital Image Processing ; John Wiley.

5. Milan Sonka et al (1999), Image processing, analysis and machine vision; Brookes/Cole, Vikas Publishing House; 2nd edition.

24DMCS23 **ARTIFICIAL INTELLIGENCE**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

The course will address key AI technologies in an attempt to help in understanding their role in cyber security and the implications of these new technologies to the world of politics. AI deficiently will complement and strengthen the cyber security practices and will improve their applications in enhancing our security.

UNIT-I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 12

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems- Algorithms and Optimization Problems -Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation–Backtracking Search–Game Playing– Optimal Decisions in Games– Alpha– Beta Pruning – Stochastic Games

UNIT-II SOFTWARE AGENTS AND APPLICATIONS 12

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems- AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation–Speech Recognition–Robot– Hardware–Perception–Planning–Moving

UNIT-III CYBER SECURITY VULNERABILITIES ANDSAFEGUARDS 12

Cyber Security Vulnerabilities-Overview- vulnerabilities in software-System administration-Complex Network Architectures- Open Access to Organizational Data- Weak Authentication-Unprotected Broadband communications-Poor Cyber Security Awareness- Cyber Security Safeguards- Access control- Cryptography- Deception-Denial of Service Filters-Ethical Hacking-Firewalls-Intrusion Detection Systems- Threat Management.

UNIT-IV SECURING WEB APPLICATION, SERVICES AND SERVERS 12

Basic security for HTTP Applications and Services- Basic Security for SOAP Services- Identity Management and Web Services- Authorization Patterns- Security Considerations- Challenges -

Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software- Botnet detection-Spam filter applications- Hacking incident forecasting-cyber security ratings

UNIT-V CYBER FORENSICS AND CASE STUDIES 12

Introduction to Cyber Forensics- Conducting disk-based analysis- Investigating Information-hiding-Scrutinizing E-mail- Tracing Internet access- Tracing memory in real-time-Case study: Cyber Security Regulations- Roles of International Law- Cyber Security Standards-The INDIAN Cyberspace- National Cyber Security Policy2013.

Total: 60 Hours

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO-1: Create self-learning and research skills to tackle a topic of interest on his/her own or as part of a team.

CO-2: Interpret the modern view of AI as the study of agents that receive percept from the environment and perform actions.

CO-3: Analyze the dimensions along which agents and environments vary, along with key functions that must be implemented in a general agent.

CO-4: Understand the concepts of Artificial intelligence

CO-5: Understand major challenges and the complexity of AI problems

Text Books

1. Stuart Russell and Peter Norvig (2010), “Artificial Intelligence: A Modern Approach”, 3rd Edition,.

2. James Graham, Richar Howard,Ryan Olson (2011), “Cyber Security Essentials”, CRC Press, Tailor and Francis Group,.

3. Nina Godbole, Sunit Belapur (2011), “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Publications, April,.

Reference Books:

1. Patterson (2012), “Introduction to Artificial Intelligence & Expert Systems”, PHIPoole, Computational Intelligence, OUP,

2. Saroj Kaushik (2014), “Logic & Prolog Programming”, New Age International Expert Systems, Giarranto, VIKAS,

Web Resources:

1. www.edureka.com
2. www.towardsdatascience.com

24DMCS24 **EMBEDDED SYSTEM**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To learn parallel and distributed algorithm's development techniques for shared memory and message passing models. To study the main classes of parallel algorithms. To study the complexity and correctness models for parallel algorithms

UNIT I INTRODUCTION TOEMBEDDED SYSTEMS 12

Definition of Embedded System - Embedded Systems Vs General Computing Systems - History of Embedded Systems - Classification, Major Application Areas - Purpose of Embedded Systems - Characteristics and Quality Attributes of Embedded Systems

UNIT II TYPICALEMBEDDEDSYSTEM 12

Core of the Embedded System - General Purpose and Domain Specific Processors - ASICs, PLDs, Commercial Off- The Shelf Components (COTS) - Memory - ROM, RAM- Memory according to the type of Interface - Memory Shadowing - Memory selection for Embedded Systems - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces

UNIT III EMBEDDED FIRMWARE 12

Reset Circuit - Brown-out Protection Circuit - Oscillator Unit - Real Time Clock - Watchdog Timer - Embedded Firmware Design Approaches and Development Languages

UNIT IV RTOS BASED EMBEDDEDSYSTEMDESIGN 12

Operating System Basics - Types of Operating Systems – Tasks - Process and Threads - Multiprocessing and Multitasking - Task Scheduling

UNIT V TASKCOMMUNICATION 12

Shared Memory - Message Passing - Remote Procedure Call and Sockets - Task Synchronization: Task Communication/Synchronization Issues - Task Synchronization Techniques - and Device Drivers - Case-Study: How to Choose an RTOS.

Total: 60 Hours

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO-1: Apply concept of Embedded system and General Computing systems.

CO-2: Understand the History and Classification of Embedded systems.

CO-3: Understand the Major Application Areas, Purpose of Embedded Systems.

CO-4: Understand about the Core of the Embedded System.

CO-5: Understand of General Purpose and Domain Specific Processors.

Text Books:

1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill 2009
2. Raj Kamal, "Embedded Systems", TMH, 2nd edition 2008.
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley 2002.

Reference Books:

1. Lyla, "Embedded Systems", Pearson 2013.
2. David E. Simon, "An Embedded Software Primer", Pearson Education, Ist Edition 2002.

Web Sources:

1. www.tutorialandexample.com/embedded-systems-tutorial/
2. www.studyelectronics.in/embedded-programming-tutorial

24DMCS31 **SECURITY ISSUES IN MACHINE LEARNING**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

Understand the fundamentals of machine learning. Identify security vulnerabilities in machine learning systems. Analyse the impact of adversarial attacks. Implement defence mechanisms against attacks. Stay updated on emerging threats and countermeasures

UNIT-I: INTRODUCTION TO MACHINE LEARNING 12

Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to BayesTheorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net)

UNIT-II: CLASSIFICATION AND REGRESSION ALGORITHMS 12

Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest,Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks Learning And Generalization, Overview of Deep Learning.

UNIT-III: SECURITYIN MACHINE LEARNING 12

Security Vulnerabilities in Machine Learning Algorithms, Evasion Attacks (Adversarial Inputs), Data Poisoning Attacks, Model Stealing Techniques, Possible Solutions to Ensure Machine Learning Security

UNIT-IV: ADVANCED LEARNING 12

Sampling-Basic Sampling methods, Monte Carlo, Gibbs Sampling – Computational Learning Theory – Mistake Bound Analysis – Reinforcement learning – Markov Decision processes, Deterministic and Non- deterministic Rewards and Actions, TemporalDifference Learning Exploration.

UNIT-V: INTRUSION DETECTION 12

Possible case studies: Machine learning for intrusion detection, Machine learning for sidechannel analysis, Privacy preserving machine learning, Adversarial machine learning.

Total: 60 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO-1: Evaluate concepts of machine learning.

CO-2: Analyze appreciate supervised and unsupervised learning and their applications

CO-3: Analyze security issues in machine learning.

CO-4: Understand the analysis of time series and overview of deep learning.

CO-5: Understand the security issues in machine learning.

Text Books:

1. Clarence Chio, David Freeman (2018), Machine Learning and Security: Protecting Systems with Data and Algorithms, 1st Edition, O'Reilly Media, 9781491979909.
2. Soma Halder, Sinan Ozdemir (2020), Hands-On Machine Learning for Cybersecurity, 1st Edition, Packt Publishing, 9781788992288.

Reference Books:

1. Nicholas Carlini, David Wagner (2017), Adversarial Machine Learning in the Physical World, IEEE Security & Privacy.
2. Battista Biggio, Igino Corona (2017), Machine Learning Security: Threats and Defenses, Journal of Artificial Intelligence Research.

Web Sources:

1. https://owasp.org/www-project-machine-learning-security-top-10/
2. https://www.google.com/url?sa=E&source=gmail&q=https://cybersecurityventures.com/

24DMCS3 PARALLEL AND DISTRIBUTED COMPUTING SYSTEM

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

To learn parallel and distributed algorithm development techniques for shared memory and message passing models, to study the main classes of parallel algorithms, to study the complexity and correctness models for parallel algorithms.

UNIT-I: INTRODUCTION 12

Basic Techniques - Parallel Computers for Increase Computation Speed - Parallel &Cluster Computing.

UNIT-II: PARALLEL PROGRAMS 12

Message Passing Technique - Evaluating Parallel Programs and Debugging - Portioning And Divide And Conquer Strategies Examples.

UNIT-III: PIPELININGTECHNIQUES 12

Pipelining - Techniques Computing Platform - Pipeline Programs Examples.

UNIT-IV: SHARED MEMORY 12

Synchronous Computations - Load Balancing - Distributed Termination Examples - Programming With Shared Memory - Shared Memory Multiprocessor Constructs For Specifying Parallel List - Sharing Data Parallel Programming Languages And Constructs - OpenMP.

UNIT-V: DISTRIBUTED SHARED MEMORYSYSTEMS 12

Distributed Shared Memory Systems And Programming Achieving Constant Memory Distributed Shared Memory Programming Primitive - Algorithms – Sorting And Numerical Algorithms.

Total: 60 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO-1: Evaluate concepts of Parallel computing systems.

CO-2: Analyze about Cluster Computing systems.

CO-3: Apply Message Passing Technique.

CO-4: Apply Parallel programs and debugging.

CO-5: Understand Pipelining Techniques and examples.

Text Books:

1. Blaise Barney (2010), Introduction to Parallel Computing, 1st Edition, CRC Press.
2. Anshul Kumar, Anant Grama, Vipin Kumar, and George Karypis (2003), Parallel Computing: Architectures and Algorithms, 1st Edition, Addison-Wesley Professional.(NA).
3. Andrew S. Tanenbaum, Maarten van Steen (2023), Distributed Systems: Principles and Paradigms, 2nd Edition, Pearson Education..

Reference Book:

1. Michael J. Quinn (2005), Parallel Programming and Applications, 1st Edition, McGraw-Hill Education(NA).
2. Martin Kleppmann (2017), Designing Data-Intensive Applications, 1st Edition, O'Reilly Media.

Web Sources:

1. https://www.google.com/url?sa=E&source=gmail&q=https://en.wikipedia.org/wiki/Parallel_computing
2. https://www.google.com/url?sa=E&source=gmail&q=https://en.wikipedia.org/wiki/Distributed_system

24DMCS33 **DATA MINING AND DATA WAREHOUSING**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

It presents methods for mining frequent patterns, associations, and correlations.
It then describes methods for data classification and prediction, and data–clustering approaches. It covers mining various types of data stores such as spatial, textual, multimedia, streams. Students will learn how to design and create a data warehouse, and how to utilize the process of extracting, transforming, and loading (ETL) data into data warehouses.

UNIT –I: DATA MINING 12

Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with Data warehouse–Major issues in Data Mining–Data Pre-processing, Association Rule Mining: Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining. Graph Pattern Mining, SPM.

UNIT-II: CLASSIFICATION 12

Classification and Prediction – Basic concepts–Decision tree induction–Bayesian classification, Rule–based classification, Lazy learner

UNIT-III: CLUSTERING AND APPLICATIONS 12

Cluster analysis–Types of Data in Cluster Analysis–Categorization of Major Clustering Methods–Partitioning Methods, Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

UNIT –IV: ADVANCED CONCEPTS 12

Basic concepts in Mining data streams–Mining Time–series data—Mining sequence patterns in Transactional databases– Mining Object– Spatial– Multimedia–Text and Web data – Spatial Data mining– Multimedia Data mining–Text Mining– Mining the World Wide Web.

UNIT-V: DATA WAREHOUSE 12

Data Warehouse-Data Warehouse Architecture- Multidimensional Data ModelData cube and OLAP Technology-Data Warehouse Implementation -DBMS schemas for Decision support - Efficient methods for Data cube computation.

Total: 60 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO- 1: Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.

CO- 2: Apply pre-processing methods for any given raw data.

CO- 3: Extract interesting patterns from large amounts of data.

CO- 4: Discover the role played by data mining in various fields.

CO- 5: Choose and employ suitable data mining algorithms to build analytical applications.

Text Books:

1. Jiawei Han, Micheline Kamber (2022), Data Mining: Concepts and Techniques, 3rd Edition, Elsevier.
2. Margaret H Dunham (2006), Data Mining: Introductory and Advanced Topics, 1st Edition, Pearson Education.

Reference Book:

1. Witten, Ian H., and Eibe Frank (2011), "Data mining: practical machine learning tools and techniques with Java implementation", Elsevier.

Web Sources:

1. *https://www.coursera.org/articles/kaggle#:~:text=Overall%2C%20Kaggle%20is%20a%20versatile,engineers%2C%20from%20learning%20and%20collaboration*

24DMCS34 CRYPTOGRAPHY AND ITS APPLICATIONS

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

To understand the fundamentals of Cryptography, acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity. To understand the various key distribution and management schemes and to explore how to deploy encryption techniques to secure data in transit across data networks.

UNIT-I: INTRODUCTION &NUMBER THEORY 12

Services, Mechanisms and attacks-the OSI security architecture-Network security model- Finite Fields and Number Theory: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm - Finite fields - Polynomial Arithmetic – Prime numbers - Fermat's and Euler's theorem -Testing for primarily – The Chinese remainder theorem-Discrete algorithms.

UNIT-II: BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 12

Data Encryption Standard-Block cipher principles-block cipher modes of operation- Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange – Elliptic curve arithmetic- Elliptic curve cryptography.

UNIT-III: HASH FUNCTIONS AND DIGITAL SIGNATURES 12

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature &authentication Protocols.

UNIT-IV: SECURITY PRACTICE &SYSTEM SECURITY 12

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems.

UNIT-V: APPLICATIONS-E-MAIL, IP &WEB SECURITY 12

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy - authentication of the source - Message Integrity - Non-repudiation - Pretty Good Privacy - S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header - Encapsulation Security Payload (ESP) - Web Security: SSL/TLS Basic Protocol-computing the keys - Encoding- Secure Electronic Transaction (SET).

Total: 60 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO-1: Analyze computer and network security threats, classify the threats and develop a Security model to prevent, detect and recover from the attacks.

CO-2: Apply Encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms.

CO-3: Apply Knowledge and understanding of Basics of number theory, Key management, Public key cryptosystems, Message authentication, Hash functions and algorithms.

CO-4: Understand network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).

CO-5: Understand with advanced security issues and technologies.

Text Books:

1. William Stallings (2017), Cryptography and Network Security: Principles and Practice, 7th Edition, Pearson.
2. Bruce Schneier (2017), Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2nd Edition, Wiley.
3. Jonathan Katz, Yehuda Lindell (2020), Introduction to Modern Cryptography, 2nd Edition, Chapman and Hall/CRC.

Reference Books:

1. Simon Singh (2003), The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography, 1st Edition, Doubleday.
2. Jean-Philippe Aumasson (2017), Serious Cryptography: A Practical Introduction to Modern Encryption, 1st Edition, Wiley.

Web Sources:

1. https://www.nist.gov/cryptography
2. https://eprint.iacr.org/

24DMCS35 **BLOCK CHAIN TECHNOLOGY**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

This course covers the technical aspects of public distributed ledgers, block chain systems, crypto currencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.

UNIT-I: BLOCKCHAIN BASICS 12

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 positions.

UNIT-II: INTRODUCTION TO BLOCK CHAINS 12

Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & HardFork, Private and Public block chain.

UNIT-III: DISTRIBUTED CONSENSUS AND CRYPTO CURRENCY 12

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, SybilAttack, Energy utilization and alternate. History, Distributed Ledger, Bit coin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.

UNIT-IV: CRYPTO CURRENCY REGULATION 12

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 Block chain.

UNIT-V: BLOCK CHAIN CONSTRUCTION 12

Case study on Naive Block chain construction, Memory Hard algorithm – Hash cash implementation, Direct Acyclic Graph, Play with Go-ethereal, Smart Contract Construction, Toy application using Block chain, mining puzzles.

Total: 60 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO-1: Evaluate a method for solving a problem case study with different perspective.

CO-2: Analyze limitations and proofs are another essential part of block chaintechnologies, which are learned for betterment of creating block chain.

CO-3: Apply latest crypto currency aspects leads students to understandsome of basic concepts of Black Market and Global Economy.

CO-4: Understand block chain technologies basics.

CO-5: Describing the history behind the block chain and learning about Vulnerability,Attacks and Side chain gives an additional support for creating a secured blockchain.

Text Book:

1. Imran Bashir (2018), Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, 1st Edition, [1] Packt Publishing.
2. Daniel Drescher (2020), Blockchain Basics: A Non-Technical Introduction in 250 Pages, 1st Edition, Wiley.
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder (2016), Blockchain Technology: A Comprehensive Introduction, 1st Edition, Cambridge University Press.

Reference Books:

1. Don Tapscott, Alex Tapscott (2016), Blockchain Revolution: A New Economic and Social Paradigm, 1st Edition, Penguin Random House.
2. Atulya K. Dutta (2018), Blockchain and Cryptocurrency Technologies: Principles and Applications, 1st Edition, CRC Press.

Web Sources:

1. https://www.google.com/url?sa=E&source=gmail&q=https://www.blockchain.com/
2. https://www.google.com/url?sa=E&source=gmail&q=https://cryptozombies.io/
   https://www.google.com/url?sa=E&source=gmail&q=https://www.coursera.org/

24DMCS36 DEEP LEARNING AND NEURAL NETWORKS

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

To introduce the idea of artificial neural networks and their architecture. To introduce techniques used for training artificial neural networks. To enable design of an artificial neural network for classification. To enable design and deployment of deep learning models for machine learning problems.

UNIT-I: ARTIFICIAL NEURAL NETWORKS 12

Introduction, Basic models of ANN, Important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks, Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT-II: UNSUPERVISED LEARNING NETWORK 12

Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT-III: INTRODUCTION TO DEEP LEARNING 12

Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

UNIT-IV: REGULARIZATION FOR DEEP LEARNING 12

Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

UNIT-V: OPTIMIZATION FOR TRAIN DEEP MODELS 12

Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate SecondOrder Methods, Optimization Strategies and Meta-Algorithms Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing.

Total: 60 Hours

COURSE OUTCOMES

CO-1: Ability to understand the concepts of Neural Networks.

CO-2: Ability to select the Learning Networks in modelling real world systems.

CO-3: Ability to use an efficient algorithm for Deep Models,

CO-4: Ability to apply optimization strategies for large scale applications.

CO-5: Evaluate the accuracy of supervised and unsupervised models and algorithms.

Text Books:

1. Richard S. Sutton, Andrew G. Barto (2020), Reinforcement Learning: An Introduction, 2nd Edition, MIT Press.
2. Masashi Sugiyama (2015), Statistical Reinforcement Learning: Modern Machine Learning Approaches, 1st Edition, CRC Press.

Reference Books:

1. Tor Lattimore, Csaba Szepesvári (2020), Bandit Algorithms, 1st Edition, Cambridge University Press.
2. Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters (2021), Reinforcement Learning Algorithms: Analysis and Applications, 1st Edition, Springer.
3. Alexander Zai, Brandon Brown (2020), Deep Reinforcement Learning in Action, 1st Edition, Manning Publications.

Web Sources:

1. http://playground.tensorflow.org/
2. https://www.coursera.org/learn/neural-networks-deep-learning

24DMCS41 **CYBER SECURITY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE

Understand the fundamental s of cyber security and cybercrimes. Understand the tools and methods in cybercrimes and understanding computer forensics.

UNIT - I INTRODUCTION TO CYBERCRIME 9

Definition, Origins of the Word Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafé and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT-II: CYBERCRIME: MOBILE AND WIRELESS DEVICES 9

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT - III TOOLS AND METHODS USED IN CYBERCRIME 9

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction to Phishing, Identity Theft (ID Theft).

UNIT-IV: UNDERSTANDING COMPUTER FORENSICS 9

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics

UNIT - V FORENSICS AND SOCIAL NETWORKING SITES 9

The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics, Introducing Various Security Policies and Their Review Process.

Total: 45 Hours

COURSE OUTCOME

At the end of the course student will be able to

CO-1: Understand the basic concepts of cyber security and cybercrimes.

CO-2: Understand the security policies and cyber laws.

CO-3: Analyse security issues in machine learning.

CO-4: Understand the analysis of time series and overview of deep learning.

CO-5: Understand the security issues in network.

Textbooks:

1. Sunit Belapure, Nina Godbole (2013), Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, 1st Edition, Wiley India Pvt Ltd..
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI (2015), Introduction to information security and cyber laws, 1st Edition, Dreamtech Press, 9789351194736.

Reference Books:

1. Thomas J. Mowbray (2014), Cybersecurity: Managing Systems, Conducting Testing, Investigating Intrusions, 1st Edition, John Wiley & Sons, Inc..
2. James Graham, Ryan Olson, Rick Howard (2010), Cyber Security Essentials, 1st Edition, CRC Press.

Web Sources:

1. **https://www.coursera.org/courses?query=cybersecurity**

4DMCS42 **ADVANCED NETWORKS**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES

To give the student ideas and insights on important design issues associated with computer networks. This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

UNIT-I REVIEW OF COMPUTER NETWORKS AND THE INTERNET 9

What is the Internet, The Network core, Access Networks and Physical media, ISPs and Internet Back bones, Delay and Lossin Packet-Switched Networks, History of Computer Networking and the Internet. Foundation of Networking Protocols: TCP/IP Model, Internet Protocols and Addressing, Equal-Sized Packets Model: ATM

UNIT-II NETWORKING DEVICES 9

Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Devices in different layers, Router Structure. The Link Layer and Local Area Networks: Link Layer: Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, PPP : The Point-to-Point Protocol.

UNIT-III ROUTING AND INTERNETWORKING 9

Network–Layer Routing, Least-Cost-Path algorithms, Non-Least-CostPath algorithms, Intra domain Routing Protocols, Inter domain Routing Protocols, Congestion Control at Network Layer. Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6. Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intra domain Multicast Protocols, Inter domain Multicast Protocols, Node-Level Multicast algorithms.

UNIT-IV TRANSPORT AND END – TO – END PROTOCOLS 9

Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control. Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing.

UNIT-V WIRELESS NETWORKS AND MOBILE IP 9

Infra structure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Types of Wireless networks. Mobile Adhoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad- Hoc Networks, Routing Protocols for Adhoc Networks.

Total: 45 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO-1: Understanding of holistic approach to computer networking.

CO-2: Ability to understand the computer networks and their applications.

CO-3: Ability to design simulation concepts related to packet forwarding in networks.

CO-4: Understand Pipelining Techniques and examples.

CO-5: Evaluate concepts of Advance computing network systems.

Text Books:

1. James F. Kurose, Keith W. Ross (2021), Computer Networking: A Top-Down Approach Featuring the Internet, 8th Edition, Pearson Education.
2. Nader F. Mir (2015), Computer and Communication Networks, 1st Edition, Pearson Education.

References :

1. Behrouz A. Forouzan (2007), Data Communications and Networking, 4th Edition, Tata McGraw Hill.
2. Andrew S. Tanenbaum (2008), Computer Networks, 4th Edition, Prentice Hall.
3. C. Sivaram Murthy, B.S. Manoj (2012), Ad hoc Wireless Networks - Architecture and Protocols, 2nd Edition, Pearson Education.

Web Sources:

1. https://onlinecourses.nptel.ac.in/noc23_cs35/preview

24DMCS43 R PROGRAMMING

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES

To provide a basic understanding of R programming, data structures, functions, how to work with packages, files and know about the data visualization and data management techniques

UNIT-I: INTRODUCTIONTO R 9

Overview of R programming - Evolution of R - Applications of R programming – Basic syntax - Basic Concepts of R: Reserved Words, Variables & Constants, Operators, Operator Precedence, Data Types, Input and Output - Data structures in R: Vectors, Matrix, List in R programming Data Frame, Factor.

UNIT-II: FUNCTIONS 9

Control flow - If. else, If else() Function - Programming for loop - While Loop, Break & next,RepeatLoop-Functions-RFunctions-FunctionReturnValue–Environment & Scope Recursive Function R Infix Operator - R Switch Function - Strings: String construction - rules - String Manipulation functions.

UNIT-III: PACKAGES AND RESHAPING 9

R packages - Study of different packages in R - R Data Reshaping: Joining Columns and Rows in a Data Frame - Merging Data Frames - Melting and Casting.

UNIT-IV: FILES AND ROBJECTS CLASS 9

Working with files - Read and writing into different types of files - R object and Class Object and Class: R S3 Class - R S4 Class R Reference Class - R Inheritance.

UNIT-V: DATA VISUALIZTION ANDDATA MANAGEMENT 9

Data visualization in R and Data Management - Bar Chart, Dot Plot, Scatter Plot (3D), Spinning Scatter Plots, Pie Chart - Histogram (3D) [including colorful ones], Overlapping Histograms – Boxplot, Plotting with Base and Lattice Graphics Missing Value Treatment
- Outlier Treatment - Sorting Datasets - Merging Datasets - Binning variables.

Total: 45 Hours

COURSE OUTCOMES

At the End of this course, the Student will be able to:

CO-1: Evaluate functions in R and implement simple iterative algorithms.

CO-2: Analyze probability distribution tools such as ANOVA.

CO-3: Apply to implement simple algorithms in R independently

CO-4: Apply visualization techniques in R in an efficient way.
CO-5: Understand the basics of R programming including matrix and vectors etc.

Text Books:

1. Hadley Wickham, Garrett Grolemund (2023), R for Data Science, 2st Edition, O'Reilly Media.
2. Roger D. Peng (2016), R Programming for Data Science, 1st Edition, Springer, 978-3319208952
3. Patrick Burns (2011), The R Inferno, 1st Edition, O'Reilly Media, 978-0596514017
4. Hadley Wickham (2020), Advanced R, 2nd Edition, Chapman and Hall/CRC, 978-1498714600

Reference Books:

1. 1. Braun, W. J., & Murdoch, D. J. (2021). *A first course in statistical programming with R.* Cambridge University Press.
2. 2. Wickham, H., & Bryan, J. (2023). *R packages.* O'Reilly Media, Inc.

***Web Sources*:**

1. **https://www.coursera.org/**
2. **https://www.edx.org/**
3. **https://stackoverflow.com/**