VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(DEEMED TO BE UNIVERSITY Estd. u/s 3 OF THE UGC ACT, 1956)

NAAC ACCREDITED

PALLAVARAM - CHENNAI - INDIA

M. Sc
Computer Science

Curriculum and Syllabus

(Based on Choice Based Credit System)

Effective from the Academic year

2020-2021

Department of Computer Science

School of Computing Sciences

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES (VISTAS), CHENNAI

CHOICE BASED CREDIT SYSTEM (CBCS)

and

LEARNING OUTCOME BASED CURRICULUM FRAMEWORK (LOCF)

M.Sc., Computer Science REGULATIONS 2021

(Applicable to all the candidates admitted from the academic year 2021-22 onwards)

1. DURATION OF THE PROGRAMME

1.1. Two years (four semesters)

1.2. Each academic year shall be divided into two semesters. The odd semesters shall consist of the period from July to November of each year and the even semesters from January to May of each year.

1.3 There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION

2.1. The details of Eligibility for Admission

Bachelor's degree in Computer Science or Computer Science & Technology or Information Technology or B.C.A. degree of Recognized University or any other degree with computer science as Core subject accepted as equivalent thereto by the Syndicate

3. MEDIUM OF INSTRUCTION

The medium of instruction is English.

4. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

A Candidate shall be eligible for the award of Degree only if he/she has undergone the prescribed course of study in VISTAS for a period of not less than two academic years and passed the examinations of all the prescribed courses of four Semesters earning a minimum of 90 credits for Core Courses and also fulfilled such other conditions as have been prescribed thereof.

5. COURSE

Each course / subject is to be designed under lectures / tutorials / laboratory or field work / seminar / practical training / Assignments / Term paper or Report writing etc., to meet effective teaching and learning needs.

6. COURSE OF STUDY AND CREDITS

The PG programme consists of a number of courses. The term 'course' is applied to indicate a logical part of the subject matter of the programme and is invariably equivalent to the subject matter of a 'paper' in the conventional sense.

Core courses i.e. major courses that compulsorily required for each of the programme of study (CC), Discipline Specific Elective Course (DSE), Generic Elective (GE) , Internship and Skill Enhancement Course (SEC).

For each course, credit is assigned based on the following:

Contact hour per week		CREDITS
1 Lecture hour	-	1 Credit
1 Tutorial hour	-	1 Credit
2 Practical hours	-	1 Credit

(Laboratory / Seminar / Project Work / etc.)

7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

7.1. **Eligibility:** Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed therefor by the Board of Management from time to time.

7.2. **Attendance:** All Students must earn 75% and above of attendance for appearing for the University Examination. (Theory/Practical)

7.3. **Condonation of shortage of attendance:** If a Student fails to earn the minimum attendance (Percentage stipulated), the HODs shall condone the shortage of attendance on medical grounds up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after paying the prescribed fee towards the condonation of shortage of attendance. The students with attendance of less than 65 and more than 50% shall be condoned by VC on the recommendation of HODs on genuine grounds, will be permitted to appear for the regular examination on payment of the prescribed condonation fee.

7.4. **Detained students for want of attendance:** Students who have earned less than 50% of attendance shall be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the University from time to time.

7.5. **Transfer of Students and Credits:** The strength of the credits system is that it permits inter Institutional transfer of students. By providing mobility, it enables individual students to develop their capabilities fully by permitting them to move from one Institution to another in accordance with their aptitude and abilities.

7.5.1. Transfer of Students is permitted from one Institution to another Institution for the same program with same nomenclature, provided, there is a vacancy in the respective program of Study in the Institution where the transfer is requested.

7.5.2. The marks obtained in the courses will be converted into appropriate grades as per the University norms.

7.5.3. The transfer students are not eligible for Ranking, Prizes and Medals.

7.5.4. Students who want to go to foreign Universities upto two semesters or Project Work with the prior approval of the Departmental / University Committee are allowed to transfer of their credits. Marks obtain in the courses will be converted into Grades as per the University norms and the students are eligible to get CGPA and Classification.

8. EXAMINATION AND EVALUATION

8.1. EXAMINATION:

(i) There shall be examinations at the end of each semester, for odd semesters in the month of October / November, for even semesters in April / May. A candidate who does not pass the examination in any course(s) shall be permitted to appear in such failed courses in the subsequent examinations to be held in October / November or April / May.

(ii) A candidate should get registered for the first semester examination. If registration is not possible owing to shortage of attendance beyond condonation limit / regulations prescribed OR belated joining OR on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after completion of the programme.

(iii) The results of all the examinations will be published through University Website. In the case of passed out candidates, their arrear results, will be published through University Website.

8.2 To Register for all subjects: Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination, except for the shortage of attendance programs. For this purpose, Students shall register for all the arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

8.3. Marks for Continuous Assessment (CA) E4xaminations and Semester End

Examinations (SEE) for all subjects.

8.3.1 There shall be no passing minimum for Continuous Assessment (CA) Examinations.

8.3.2 For Semester End Examination, passing minimum shall be 50% (Fifty Percentage) of the maximum marks prescribed for the Course/Practical/Project and Viva-Voce.

8.3.3 In the aggregate (CA and SEE) the passing minimum shall be of 50%.

8.3.4. He / She shall be declared to have passed the whole examination, if he/she passes in all the courses wherever prescribed in the curriculum by earning 90 CREDITS for all subjects.

9. Question Paper Pattern for Semester End Examination

SECTION – A	10 questions 10 X 3 = 30 Marks
SECTION – B	5 questions out of 8 questions 5 X 8 = 40 Marks
SECTION – C	2 questions out of 4 questions 2 X 15 = 30 Marks
	Total 100 Marks

10. SUPPLEMENTARY EXAMINATION: Supplementary Examinations are conducted for the students who appeared in the final semester examinations. Eligible criteria for appearing in the Supplementary Examinations are as follows:

10.1. Eligibility: A Student who is having a maximum of two arrear papers is eligible to appear for the Supplementary Examination.

10.2. Non-eligibility for those completed the program: Students who have completed their Program duration but having arrears are not eligible to appear for Supplementary Examinations.

11. RETOTALLING, REVALUATION AND PHOTOCOPY OF THE ANSWER SCRIPTS:

11.1. Re-totaling: All PG Students who appeared for their Semester Examinations are eligible for applying for re-totaling of their answer scripts.

11.2. Revaluation: All current batch Students who have appeared for their Semester Examinations are eligible for Revaluation of their answer scripts. Passed out candidates are not eligible for Revaluation.

11.3. Photocopy of the answer scripts: Students who have applied for revaluation can download their answer scripts from the University Website after fifteen days from the date of publication of the results.

12. The examination and evaluation for MOOCs will be as per the requirements of the regulatory bodies and will be specified at the beginning of the Semester and notified by the university NPTEL-SWAYAM Coordinator (SPOC).

13. CLASSIFICATION OF SUCCESSFUL STUDENTS

13.1. CORE SUBJECTS, ELECTIVES COURSES AND PROJECT: Successful Students passing the Examinations for all courses and securing the marks

a) CGPA 9.00 to 10.00 shall be declared to have passed the examination in **First class with Outstanding**.

b) CGPA 7.50 to 8.99 shall be declared to have passed the examination in **First class with distinction**.

c) CGPA 6.00 to 7.49 shall be declared to have passed the examination in **First Class**.

d) CGPA 5.00 to 5.99 in the aggregate shall be declared to have passed the examination in the **SECOND** Class.

14. MARKS AND GRADES: The following table shows the marks, grade points, letter grades and classification to indicate the performance of the Student:

14.1. **Computation of Grade Point Average (GPA)** in a Semester, Cumulative Grade Point Average (CGPA) and Classification

GPA for a Semester: = $\sum iCiGi \div \sum iCi$ That is, GPA is the sum of the multiplication of grade points by the credits of the courses divided by the sum of the credits of the courses in a semester.

Where, Ci= Credits earned for course i in any semester,

Gi = Grade Points obtained for course i in any semester

n = Semester in which such courses were credited.

CGPA for the entire programme: = $\sum n\sum iCniGni \div \sum n\sum iCni$ That is, CGPA is the sum of the multiplication of grade points by the credits of the entire programme divided by the sum of the credits of the courses of the entire programme

Grade Conversion Table – PG			
Range of Marks	**Grade Points**	**Letter Grade**	**Description**
90 - 100	10	O	Outstanding
82 - 89	9	A+	Excellent
75 - 81	8	A	Very Good
67 - 74	7	B+	Good
60 - 66	6	B	Average
50 - 59	5	C	Mininum for pass
0 - 49	0	RA	Reappear
		AAA	Absent

14.2. Letter Grade and Class CGPA

Overall Performance - UG		
CGPA	**GRADE**	**CLASS**
5.00 - 5.99	C	Second Class
6.00 - 6.69	B	First Class
6.70 - 7.49	B+	
7.50 - 8.19	A	First Class with Distinction*
8.20 - 8.99	A+	
9.00 - 10.00	O	First Class - Outstanding*

The Students who have passed in the first appearance and within the prescribed semester of the PG Programme (Major, Elective courses and Project only) are eligible.

15. RANKING

- Students who pass all the examinations prescribed for the Program in the FIRST APPEARANCE ITSELF ALONE arxe eligible for Ranking / Distinction.
- In the case of Students who pass all the examinations prescribed for the Program

with a break in the First Appearance are only eligible for Classification.

- Students qualifying during the extended period shall not be eligible for RANKING.

16. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAMS TO QUALIFY FOR A DEGREE

16.1. A Student who for whatever reasons is not able to complete the programs within the normal period (N) or the Minimum duration prescribed for the programme, may be allowed two years period beyond the normal period to clear the backlog to be qualified for the degree. (Time Span = N + 2 years for the completion of programme)

16.2. In exceptional cases like major accidents and child birth an extension of one year considered beyond maximum span of time (Time Span= N + 2 + 1 years for the completion of programme).

17. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Academic Council with the approval of the Board of Management.

Program Educational Outcomes(PEO)

PEO1: Graduates will be acquired knowledge, both theoretical and applied, related to core areas of computer science.

PEO2: Graduates will be prepared with Ethical Attitude, Effective Communication Skills and admit themselves as ethical and responsible citizens with social commitments.

PEO3: Graduates will be demonstrated their ability to work effectively as a team member and/or leader in an ever-changing professional environment.

PEO4: Graduates will be worked productively as computer professionals by demonstrating effective use of oral and written communication, working competently as a member of a team unit, adhering to ethical standards in the profession.

PEO5: Graduates will be gain multidisciplinary knowledge through real-time projects to meet industry needs.

Program Outcomes(PO)

PO1: Domain Expertise: communicate computer science concepts, designs, and solutions effectively and professionally.

PO2: Computing Skills and Ethics: apply knowledge of computing to produce effective designs and solutions for specific problems.

PO3: Lifelong Learning and Research: identify, analyse, and synthesize scholarly literature relating to the field of computer science.

PO4: Modern Tool Usage: use software development tools, software systems, and modern computing platforms.

PO5: Social Contribution: an understanding of professional, ethical, legal, security and social issues and responsibilities

PO6: Ethics: capable of evaluating personal and professional choices in terms of codes of ethics and ethical theories and understanding the impact of their decisions on themselves, their professions, and on society

PO7: Life Long Learning: apply design and development principles in the construction of software systems of varying complexity.

Program Learning Outcomes(PLO)

PLO1: Demonstrate understanding of the principles and working of the hardware and software aspects of computer systems.

PLO2: Ability to understand the structure and development methodologies of software systems. Possess professional skills and knowledge of software design process. Familiarity and practical competence with a broad range of programming language and open source platforms.

PLO3: Be acquainted with the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems.

M.Sc. COMPUTER SCIENCE CURRICULUM

Total number of Credits: 90

Category	Code No	Course	Hours/Week				Maximum Marks		
			Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER I									
Core	21CMCS11	Linux Programming	4	0	0	4	40	60	100
Core	21CMCS12	Design and Analysis of Algorithm	4	0	0	4	40	60	100
Core	21CMCS13	Scripting Language	3	0	4	4	40	60	100
Core	21PMCS11	Linux Programming Lab	0	0	4	2	40	60	100
DSE	21DMCS--	DSE 1	4	0	0	4	40	60	100
DSE	21DMCS--	DSE 2	4	0	0	4	40	60	100
SEC		Soft Skill1/ Sector Skill Course	2	0	0	2	40	60	100
			21	**0**	**8**	**24**			
SEMESTER II									
Core	21CMCS21	Advanced DBMS	4	0	0	4	40	60	100
Core	21CMCS22	ASP .NET Programming	4	0	0	4	40	60	100
Core	21CMCS23	Pattern Recognition	4	0	0	4	40	60	100
Core	21PMCS21	Advanced DBMS Lab	0	0	4	2	40	60	100
Core	21PMCS22	ASP .NET Programming Lab	0	0	4	2	40	60	100
DSE	21DMCS--	DSE 3	4	0	0	4	40	60	100
SI		Internship	0	0	4	2	40	60	100
SEC		Soft Skill2/ Sector Skill Course	2	0	0	2	40	60	100
			18	**0**	**12**	**24**			
SEMESTER III									
Core	21CMCS31	Natural Language Processing	4	0	0	4	40	60	100
Core	21CMCS32	Deep Learning	4	0	0	4	40	60	100
Core	21CMCS32	Mobile Application Development	3	0	4	4	40	60	100
Core	21PMCS31	Mini Project	0	0	4	2	40	60	100
DSE	21DMCS31	DSE 4	4	0	0	4	40	60	100
DSE	21DMCS31	DSE 5	4	0	0	4	40	60	100
SEC		Soft Skill 3/ Sector Skill Course	2	0	0	2	40	60	100
			21	**0**	**8**	**24**			
SEMESTER IV									
Core	21CMCS41	Internet of Things	4	0	0	4	40	60	100
GE	21GMCS41	Generic Elective-I	4	0	0	4	40	60	100
Core	21PMCS41	Project Work	0	0	20	10	40	60	100
			8	**0**	**20**	**18**			

CA - Continuous Assessment, SEE - Semester End Examination

List of Discipline Specific Elective Courses

Theory of Automata
Computational Intelligence
Block Chain Technology
Cloud Computing
Software Quality Assurance
Cryptography and its Applications
Big Data Analytics
Parallel and Distributed Computing System
Neural Networks
Advanced Compiler Design
Mobile Computing
R Programming
Artificial Intelligence
Embedded System
Security Issues in Machine Learning

List of Generic Elective Courses

Human Resource Management
Social Networks
Geographical Information System
Technical Writing in Computer Science

Syllabus
Core Courses

21CMCS11 LINUX PROGRAMMING 4 0 0 4

Course Objective (Employability)

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. . To equip the students with the industry needs.

Course Outcome

CO-1: Focuses on open source software, an introduction to Linux systems and the use of Git, Understand the basics of Unix/Linux environment and Master the Linux administration.

CO-2: Learn how to install, configure and troubleshoot an operating system on a PC.

CO-3: Learn how to develop applications for the Linux environment. Know about History of Linux and what differentiates it from other UNIX -like operating systems

CO-4: Explore different types of editors in Linux using for shell programming.

CO-5: Understand about Linux File Structures and Managing files.

CO-6: Manage Directories and file and directory permissions.

CO-7: Understand all the Linux utilities, and implement shell scripting. Write shell scripts to automate various tasks.

CO-8: Understand about control structures, text expressions and loops. Develop simple Shell scripts.

CO-9: How to administer, configure and upgrade Linux systems running on the major Linux distribution families: Red Hat, SUSE, Debian / Ubuntu.

CO-10: Get hands-on experience with the necessary tools and methods for Linux application development and learn about the features and techniques that are unique to Linux.

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 **12**

The command line – Command line Editing - Creating files using the vi editor: Text editors – The vi editor - Managing Documents: Locating files in LINUX – Standard files – Redirection – Filters – Pipes - Ending Processes: ps and kill - The C Shell: Command Line Editing and - C Shell Command Line Editing - C Shell History - The TCSH Shell - TCSH Command Line Completion - TCSH History Editing - The Z-shell

UNIT III LINUX FILE STRUCTURE **12**

Linux file types – File structures – managing Files - Managing Directories – File and Directory operation – File Management Operation : File and Directory permissions.

UNIT IV THE SHELL SCRIPTS AND PROGRAMMING **12**

Shell Variables – Definition of Variables - Variable values - Strings – Values from Linux commands – Shell Scripts – User Defined commands - Executing Scripts –Script Arguments – Environment Variables and Subshells Variable – Control Structures – Test operations – Conditional Control Structures –Test Expressions – Shell conditions – Shell loops – Simple Programs using shell scripts.

UNIT V LINUX SOFTWARES **12**

Software Management -Software Package Types - Red Hat Package Manager(RPM) - Debian - Installing Software from Compressed Archives: .tar.gz - Command and Program Directories - Office and Database Applications - Running Microsoft Office on Linux: Cross Over OpenOffice.org - KOffice - KOffice Applications - GNOME Offi ce - Document Viewers - PDA Access - Database Management - SQL Databases (RDMS) - Xbase Databases - Editors - GNOME Editor: Gedit - K Desktop Editors.

Total : 60 Hours

Text Books:

1. Richard Petersen, “Linux: The Complete Reference”, Sixth Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi, Edition 2008.
2. Neil Matthew, Richard stones, Alan Cox, “Beginning Linux Programming”, Wrox Publication.

Reference Books:

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

21CMCS12 DESIGN AND ANALYSIS OF ALGORITHM 4 0 0 4

Course Objective: (Employability)

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

Course Outcomes:

CO-1: Understand the concepts of algorithm definition and specification.
CO-2: Ability to analyze the Complexity and performance of algorithms.
CO-3: Ability to choose 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: To clear up troubles the usage of set of rules design methods in Divide and Conquer.
CO-6: Understand the set of rules design methods in Greedy Method.
CO-7: Able to implement Quick sort, Merge sort algorithm, BFS and DFS Algorithms.
CO-8: Ability to understand the usage of rules design methods about Dynamic Programming.
CO-9: Ability to design methods about Backtracking.
CO-10: Able to implement backtracking algorithm for the N-queens problem.

UNIT-I: INTRODUCTION **12**

Introduction - Definition of Algorithm – Pseudo Code Conventions – Recursive Algorithms– Time And Space Complexity –Big-"Oh" Notation – Practical Complexities – Randomized Algorithms – Repeated Element – Primarily Testing.

UNIT- II: DIVIDE AND CONQUER **12**

Divide And Conquer: General Method – Binary Search – Finding the Maximum and Minimum- Merge Sort - Quick Sort- Strassen's Matrix Multiplication.

UNIT- III: GREEDY METHOD **12**

Greedy Method: General Method-Knapsack Problem-Tree Vertex Splitting-Job Sequencing with Deadlines-Minimum Cost Spanning Trees- Prim's Algorithm- Kruskal's Algorithm-Single Source Shortest Paths.

UNIT- IV: DYNAMIC PROGRAMMING **12**

Dynamic Programming: General Method-Multistage Graph-All Pair Shortest Path-Optimal Binary Search Trees-0/1 Knapsack -Traveling Sales Person Problem-Flow Shop Scheduling.

UNIT- V: BACKTRACKING **12**

Backtracking: General Method, 8- Queen's Problem-Sum of Subsets-Graph Coloring-Hamilton Cycles-Knapsack Problem. Branch and Bound: The Method-0/1 Knapsack Problem-Traveling Salesmen Problem.

Total :60 Hrs

Text book:

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

Reference books:

1. Manas Ranjan Kabat, DESIGN AND ANALYSIS OF ALGORITHMS, PHI Learning Pvt. Ltd., 2013.

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

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

21CMCS013 SCRIPTING LANGUAGES 3 0 4 4

Course Objective: (Employability)

Student 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.

Course Outcomes:

CO-1: To master the theory behind scripting and its relationship to classic programming.

CO-2: To survey many of the modern and way cool language features that show up frequently in scripting languages

CO-3: To gain some fluency programming in JavaScript, VB Script, CGI and PERL.

CO-4: To design and implement one's own scripting language

CO-5: Gain knowledge of client side scripting, validation of forms.

CO-6: Have understanding of server side scripting with PERL & CGI language.

CO-7: Have understanding of what is HTML

CO-8: Create applications by using the concepts like Java Script, HTML , PERL.

CO-9: Demonstrate the basic techniques used to create scripts for automating system administrative tasks.

CO-10: Construct web scraping scripts to programmatically obtain data and content from web pages.

UNIT I HTML **9**

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 **9**

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 **9**

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 **9**

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 **9**

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: 45 Hours

Text Books:

1. Web Enable Commercial Application Development Using HTML, DHTML, Javascript, PERL and CGI, Ivan Bayross, BPB Publications, 2006.

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

3. Mastering Javascript, J.Jaworski, BPB Publications, 1999.

Reference Books:

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

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

Practical:

1. Create a table to show your class time table using HTML.
2. Use frames such that 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 e-mail 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: 60 Hours

21PMCS11 LINUX PROGRAMMING LAB 0 0 4 2

Course Objective (Skill Development)

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 "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: 60 Hours

21CMCS21 ADVANCED DBMS 4 0 0 4

Course Objective

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

Course Outcome

CO-1: Ability to define a problem at the view level & ability to understand the physical structure of the database to handle data.

CO-2: Students would be able to apply the logic in different applications.

CO-3: Ability to normalize the database & understand the internal data structure.

CO-4: Students would clearly understand the transaction system & could extract data efficiently.

CO-5: Define user accounts and associated resources and privileges

CO-6: Make backup copies and recover the state of the DB after a system failure

CO-7: Establish and manage audit controls

CO-8: Understand the notion of transaction and its ACID properties

CO-9: Have knowledge of concurrency control mechanisms

CO-10: Define links between databases on different nodes and work with the multiple databases

UNIT-1COMPARISON 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, Denormalization

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, multiquery 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

Text Books:

1. Date C. J, “An Introduction to Database Systems”, Addison Wesley Longman, 8th Edition, 2003.
2. Catell, R.G.G., Barry, D.K., Berler, M., et al, “The Object Data Standard: ODMG 3.0”, Morgan Kaufmann, 2000.
3. Silberschatz A., Korth H., and Sudarshan S, “Database System Concepts”, McGraw-Hill, 6th Edition, 2010.

Reference Books:

1. Charles F. Goldfarb, Paul Prescod, “The XML Handbook, Prentice Hall”, 5th Edition, 2004.
2. Thomas M. Connolly, Carolyn Begg, “Database Systems: Practical approach to Design, Implementation and Management”, Pearson Education Limited, 6th edition, 2012.

21CMCS22 ASP.NET PROGRAMMING 4 0 0 4

Course Objective

This course introduces the concepts and gain knowledge about the ASP.Net and helps the students to develop Dot Net based application using ADO.NET

Course Outcome

CO-1: To Familiar about DOS,GUI environment for developing good quality software project

CO-2: To exhibit the knowledge of programming with basic building blocks of ASP.net environment

CO-3: To know how to design a web application withASP.Net Controls

CO-4: To authenticate web pages and to know how to develop event related with error free applications.

CO-5: To acquire web development skills using ASP.Net which is the industry demands

CO-6: To apply validation controls in developing online client page design for reservation, banking.

CO-7: To design and know the various web service architectures and their standards

CO-8: To acquire web development skills using ASP.Net which is the industry demands

CO-9: Students will be able to establish the connectivity between form with database

CO-10: Students will be able to develop application using dotnet

UNIT-I INTRODUCTION TO .NET AND ASP.NET 12

The DOS Paradigm - The GUI Paradigm - The .Net Paradigm - .Net framework - Types, Objects and Namespaces - Setting up ASP.Net and IIS. Overview of dynamic web page-introduction & features of ASP.NETunderstanding ASP.NET controls-applications-web servers, installation of IIS.

UNIT-II ASP.NET CONTROLS 12

ASP.NET Controls: Web form, web forms Controls - server-controls-client controls-adding controls to web Formbuttons-text box-labels-checkbox-radio buttons-list box. Adding controls a runtimeRunning a web application- creating a multiform web project

UNIT III ASP.NET WEB PROGRAMMING **12**

Form validation: client side and server side validation- Validation controls: required field comparison range- Calendar control- Ad rotator control- Internet Explorer control.How to manage state- how to use view state, session state and application state. How to use cookies. XML In .NET: XML Basics- Attributes- Fundamentals of XML Classes: Document- Text Writer- Text Reader- XML Validations- XML In ADO.NET,-Data Document

UNIT IV WEBSERVICES **12**

Web Services: Introduction- State Management- View State- Session State- Application State- Service Description Language- Building & Consuming A Web Service. Web Application Development- Caching- Threading Concepts- Creating Threads In .NETManaging Threads- Thread Synchronization- Features Of .NET- Role Based Security & Code - Access Security- Permissions

UNIT V ADO.NET **12**

ADO.NET: Overview of ADO.NET- from ADO to ADO.NET- ADO.NET Architecture- Accessing data using data adapters and datasets- using command and data Reader- binding data to data bind controls- displaying data in data grid.

Total: 60 Hours

Text Books:

1. Mathew Macdonald - The Complete Reference ASP.NET - Tata McGraw Hill Publishing Pvt Ltd, 2005
2. Professional ASP.NET - Wrox publication PVT Ltd.
3. ASP.NET Developer's Guide - Greg Buczek - Tata McGraw Hill Edition
4. Michael Otey and DenielleOtey, "ADO.NET Complete Reference", Tata Macraw Hill Publication, 4th Edition,2007.
5. Math J. Croush , "ASP.net & VB.net web programming" (Pearson Education) ISBN-10: 0201734400

Reference Books:

1. Introduction to .NET framework - Wrox publication.
2. ASP.NET Unleashed - BPB Publication.Alex , "Professional ASP.NET 1.1", Wrox Publications, 2nd Edition, 2004.
3. ASP.NET Projects – Building 10 Enterprise Projects – Eric A. Smith

21CMSC23 PATTERN RECOGNITION 4 0 0 4

Course Objective

The students can learn about supervised and unsupervised pattern classifiers and familiarize about different feature extraction techniques. The learning also explores the role of Hidden Marko model and SVM in pattern recognition and to understand the application of Fuzzy logic and genetic algorithms for pattern classifier.

Course Outcomes:

CO-1: Understand the fundamentals of Pattern Recognition techniques.

CO-2: To learn function, model and problems in Pattern Recognition

CO-3: Understand the principles of Clustering approaches to Pattern Recognition.

CO-4: To know the details about Graph theoretic approach to pattern Clustering and validity

CO-5: Discuss the feature extraction and elements of Pattern Recognition

CO-6: Understand the Syntactic Pattern Recognition techniques.

CO-7: To learn about the HMM.

CO-8: Understand the feature selection and classification using SVM

CO-9: Understand the Neural Network approach to Pattern Recognition.

CO-10: To learn Fuzzy logic and Pattern Classifiers using Genetic Algorithms

UNIT I PATTERN CLASSIFIER 12

Overview of Pattern recognition – Discriminate functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II CLUSTERING 12

Clustering for unsupervised learning and classification–Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 12

Principal Component Analysis (PCA) – Fisher Linear discriminate analysis – Expectation – maximization (EM) – Gaussian mixture models. Feature selection through functional approximation – Elements of formal grammars, Syntactic description – Stochastic grammars – Structural Representation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE 12

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT V NEURAL PATTERN RECOGNITION 12

Neural Networks fundamentals, Learning in neural networks, Artificial Neural Networks model, activation functions, weights, Neural Network based Pattern Associators, Introduction Feed forward Network Architecture, Training in Feed forward Networks, GDR, Derivation of Delta Rule, Back propagation Algorithm, Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms

TOTAL: 60 Hours

Text Books:

1. M. Narasimha Murthy and V. Susheela Devi, "Pattern Recognition", Springer 2011.

2. Menahem Friedman , Abraham Kandel, "Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches", World Scientific publishing Co. Ltd, 2000.

Reference Books:

1. Andrew Webb, "Stastical Pattern Recognition", Arnold publishers, London,1999

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

3. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, 1992.

4. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2001

5. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press. 2009.

21PMCS21 ADVANCED DBMS LAB 0 0 4 2

Course Objective

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

1. Learning basic DDL, DML, DCL and TCL commands
2. Working with dual table.
3. Use of Joins and Sub queries.
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: 60 Hours

21PMCS22 ASP .NET PROGRAMMING LAB 0 0 4 2

Course Objective: This course gives practical training in Network programming using Active Server Pages ActiveX Data Object Dot Net with various applications.

1. Demonstration of Login Processing using ASP.NET
2. Demonstration of Validation controls in ASP.NET
3. Deployment of Calendar Control inASP.NET
4. Traversing and selecting a Product Name displayed in dropdown list, through coding in The Form Load Event inASP.NET
5. Creation of Web Application in ASP.NET for Conditions-based book issue in a Library
6. Construction of Banking Application with Implementation of Web-user controls in ASP.NET.
7. Create web Application for Course Registration in ASP.NET with ADO.NET
8. Create web Application for Airline reservation in ASP.NET with ADO.NET
9. Create web Application for Shopping Cart in ASP.NET with ADO.NET
10. Create web Application for Job portal in ASP.NET with ADO.NET
11. Create web Application for On-Line Telephone Billing System in ASP.NET with ADO.NET
12. Create web Application for Hospital Management System inASP.NET with ADO.NET

Total: 60 Hours

21CMCS31 NATURAL LANGUAGE PROCESSING 4 0 0 4

Course Objective

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.

Course Outcome

CO-1: An ability to apply core computer science concepts and algorithms, such as dynamic programming.

CO-2: To understand the linguistic phenomena and to explore the linguistic features relevant to each NLP task.

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

CO-4: The student will be familiar with some of the NLP literature and will read and suggest improvements to published work.

CO-5: The student will also analyze experimental results and write reports for each course project to develop scientific writing skills.

CO-6: To understand natural language processing and to learn how to apply basic algorithms in this field.

CO-7: To get acquainted with the algorithmic description of the main language levels:morphology, syntax, semantics, and pragmatics, as well as the resources of natural language data .

CO-8: Understanding of state-of-the-art algorithms and techniques for text-based processing of natural language.

CO-9: To demonstrate understanding of human languages and be familiar with the most main stream descriptive and theoretical frameworks for handling their properties.

CO-10: To be able to determine when a problem's complexity requires an NLP solution.

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

Text Books:

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

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin /Cummings publishing company, 1995.

21CMCS32 DEEP LEARNING 3 0 0 3

Course Objectives

To understand the major technology trends driving Deep Learning and apply fully connected deep neural networks. This course is used to analyse the key parameters and hyper parameters in a neural network's architecture.

Course Outcomes

CO-1: To Demonstrate the mathematical foundation of neural network.
CO-2: To understand about Information theory.
CO-3: To learn the machine learning basics.
CO-4: To understand Supervised and Unsupervised Learning.
CO-5: To study Challenges in Neural Network Optimization.
CO-6: To learn Semi-Supervised Learning and Multi-Task Learning.
CO-7: To understand the Concept of Convolutional Networks.
CO-8: To learn Efficient Convolution Algorithms.
CO-9: To study about Deep Recurrent Networks.
CO-10: To understand about sequence modeling.

UNIT I PROBABILITY AND INFORMATION THEORY 9

Random Variables- Probability Distributions- Marginal Probability- Conditional Probability- Expectation- Variance and Covariance- Bayes' Rule-Information Theory - Numerical Computation- Overflow and Underflow- Gradient-BasedOptimization- Constrained Optimization- Linear Least Squares.

UNIT II MACHINE LEARNING BASICS 9

Machine Learning Basics and under fitting, Hyper parameters and Validation Sets Estimators-Bayesian Statistics- Supervised and Unsupervised Learning-Stochastic Gradient Descent- Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR- Gradient-Based Learning- Hidden Units-Architecture Design- Back-Propagation and other Differentiation Algorithms.

UNIT III REGULARIZATION FOR DEEP LEARNING **9**

Regularization for Deep Learning: Parameter Norm Penalties- Norm Penalties as Constrained Optimization- Regularization and Under-Constrained Problems- Dataset Augmentation- Noise Robustness- Semi-Supervised Learning- Multi-Task Learning- Optimization for Training Deep Models: Pure Optimization- Challenges in Neural Network Optimization- Basic Algorithms- Algorithms with Adaptive Learning Rates- Optimization Strategies and Meta-Algorithms.

UNIT IV CONVOLUTIONAL NETWORKS **9**

Convolutional Networks: The Convolution Operation, Pooling- Convolution- Basic Convolution Functions -Structured Outputs, Data Types -Efficient Convolution Algorithms- Random or Unsupervised Features -Basis for Convolutional Networks.

UNIT V SEQUENCE MODELLING **9**

Sequence Modeling: Recurrent and Recursive Nets- Unfolding Computational Graphs- Recurrent Neural Networks- Bidirectional RNNs-Deep Recurrent Networks - Recursive Neural Networks- Echo State Networks- LSTM –Gated RNNs- Optimization for Long-Term Dependencies.

Total Periods: 45 hours

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition, 2017.

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O’Reilly, Shroff Publishers, 2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, Douwe Osinga, O’Reilly, Shroff Publishers, 2019.

21CMCS32 MOBILE APPLICATION DEVELOPMENT 3 0 4 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 marketplace for distribution.

Course Outcome

CO-1: Able to know the requirements for mobile applications.

CO-2: Understand the basic Frameworks and tools used in mobile application.

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

CO-4: Able to understand the gesture based UIs.

CO-5: Understand the memory management.

CO-6: Implement the design using JSON.

CO-7: Deploy mobile applications in Android and iPhone marketplace for distribution.

CO- 8: Understand the capabilities and limitations of mobile devices.

UNIT I INTRODUCTION 9

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

UNIT II USER INTERFACE 9

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 9

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 9

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 TOOLS 9

Google Android Platform – Eclipse Simulator – Android Application Architecture –Event based programming – Apple iPhone Platform – UI tool kit interfaces – Event handling and Graphics services – Layer Animation.

Total: 45 Hours

Text Books:

1. Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, "Programming Android", O"Reilly, 2011.
2. Reto Meier, Wrox Wiley, "Professional Android 2 Application Development", 2010.
3. Alasdair Allan, "iPhone Programming", O"Reilly, 2010.

References:

1. Wei-Meng Lee, "Beginning iPhone SDK Programming with Objective-C", Wrox Wiley, 2010.
2. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and interactions", Wiley, 2009.

Practical:

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: 60 Hours

21CMCS41 INTERNET OF THINGS 4 0 0 4

Course Objective: Student will understand the evolution of internet technology and need for IoT. The course will cover the basics of communications concepts, characteristics of sensors, protocols and the need of security in the Internet of Things.

Course Outcomes:

CO-1: Ability to analyze the concepts the network concepts like TCP-IP, subnetting, IPV4.

CO-2: Understanding the architecture of IoT reference layer.

CO-3: Ability to analyze the characteristics sensors, edge computer cloud and its peripherals.

CO-4: Learn about open source hardware's and the IoT infrastructure.

CO-5: Understand the protocols like MQTT, UDP, etc.,

CO-6: Learn about the other protocols and the gateway.

CO-7: Study about the Communication Pattern of IoT and its protocol Architecture.

CO-8: Learn about the selection of wireless technologies.

CO-9: Understanding the need for encryption and the standard encryption protocol.

CO-10: To know about the security issues and threat analysis.

UNIT I: EVOLUTION OF IOT 12

Review of computer communication concepts- OSI layers – components - packet communication – Networks - TCP-IP – subnetting - IPV4 addressing and challenges. IPV6 addressing - IoT architecture reference layer.

UNIT II: INTRODUCTION TO IOT COMPONENTS 12

Characteristics IoT sensor nodes - Edge computer - cloud and peripheral cloud - single board computers- open source hardware's - Examples of IoT infrastructure.

UNIT III: IOT PROTOCOLS AND SOFTWARES 12

MQTT – UDP - MQTT brokers - publish subscribe modes – HTTP - COAP - XMPP and gateway protocols – IoT Communication Pattern – IoT protocol Architecture - Selection of Wireless technologies.

UNIT IV: IOT SECURITY **12**

Need for encryption - standard encryption protocol - light weight cryptography - Quadruple Trust Model for IoT – Threat Analysis and model for IoT-A, Cloud security

UNIT V: ARDUINO PROGRAMMING **12**

Arduino UNO-Setup-IDE Overview-Sktech structure- Data types-Operators-Control statement-Loops-Arrays-String- Math Library-Random Number-Interrupts-Example Program.

. **Total: 60 Hours**

Text Books:

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016 2.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.

Reference Books:

1. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.
2. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014.
3. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

21RMCS41 PROJECT WORK 0 0 20 10

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 some industry/ 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 student can commence working on it.

Discipline Specific Electives

THEORY OF AUTOMATA 4 0 0 4

Course Objective

The goal of this course is to provide an understanding of basic concepts in the theory of computation. Students will learn about a variety of issues in the mathematical development of computer science theory, particularly finite representations for languages and machines.

Course Outcome

CO - 1: Master structural representation and finite automata.

CO - 2: Be familiar with application of finite automata.

CO - 3: Understand Regular Expression and its concepts.

CO - 4: Implement the concepts of Regular Expression.

CO - 5:.Master context-free languages, push-down automata.

CO - 6: Apply the concept of CFG

CO - 7: Master Turing recognizable languages.

CO - 8: Utilize the ideas of turing machines

CO - 9. Be exposed to a broad overview of the theoretical foundations of computer science.

CO - 10: Be familiar with thinking analytically and intuitively for problem-solving situations in related areas of theory in computer science.

UNIT I AUTOMATA THEORY 12

Introduction – Structural representation – Automata and Complexity –Alphabets – Strings – Languages – Problems. Finite Automata: Introduction– Deterministic Finite Automata – Non-Deterministic Finite Automata - Application: Text Search – Finite Automata with Epsilon-Transitions.

UNIT II REGULAR EXPRESSIONS 12

Regular Expressions – Finite Automata and Regular Expressions – Applications of Regular Expressions - Algebraic Laws for Regular Expressions – Proving Languages not to be Regular – Decision Properties of Regular Languages – Equivalence and Minimization of Automata – Moore and Mealy Machines.

UNIT III CONTEXT-FREE GRAMMARS 12

Definition – Derivations using a Grammar – Leftmost and Rightmost Derivations – The Language of a Grammar – Sentential Forms - Parse Trees - Pushdown Automata: Definition – Languages of a PDA – Equivalence of PDA's and CFG's - Deterministic Pushdown Automata.

UNIT IV TURING MACHINE 12

Introduction – Notation - Description – Transition Diagram – Languages – Turing Machines and Halting – Programming Techniques for Turing Machines – Multitape Turing Machine – Restricted Turing Machines – Turing Machines and Computers.

UNIT V INTRACTABLE PROBLEMS 12

The Classes P and NP - The NP Complete Problem – Complements of Languages in NP – Problems solvable in polynomial space.

Total : 60 Hours

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 2001.

Reference Books:

1. S.P.Eugene Xavier, "Theory of Automata, Formal Languages and Computation", New Age International, 2004.
2. A.M.Natarajan, A.Tamilarasi, P.Balasubramani, "Theory of Computation, New Age International", 2003.
3. E.V.Krishnamurthy, "Introductory Theory of Computer Science", East-West Press Pvt. Ltd, 1983.
4. Bernard M. Moret, " The Theory of Computation", Pearson Education, 1998.
5. Web resource: www.nptel.ac.in.
6. Webresource:www.ocw.mit.edu/courses/mathematics/18-404j-theory-of-computation-fall-2006.
7. Web resource: www.coursera.org/courses.

COMPUTATIONAL INTELLIGENCE 4 0 0 4

Course Objective:

The course makes students familiar with basic principles of various computational methods of data processing that can commonly be called computational intelligence. To help the students to design and build CI algorithms and approaches to real-life problems, analyses and improve these algorithms and approaches, discuss decisions made during the development processes

Course Outcomes:

CO-1: To provide a strong foundation on fundamental concepts in Computational intelligence.

CO-2: To enable Problem-solving through various searching techniques.

CO-3: To apply these techniques in applications which involve perception, reasoning and learning.

CO-4: To apply Computational Intelligence techniques for information retrieval

CO-5: To apply Computational Intelligence techniques primarily for machine learning.

CO-6: Design and evaluate Fuzzy Logic

CO-7: Apply the Intelligent techniques for problem solving

CO-8: Acquire basic idea about optimization

CO-9: Discuss design of real time applications using computational intelligence

CO-10: Improve problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, computer vision, automatic programming and machine learning

UNIT I INTRODUCTION 12

Artificial Intelligence – a brief review – Pitfalls of traditional AI – Why Computational Intelligence? – Computational intelligence concept - Importance of tolerance of imprecision and uncertainty - Constituent techniques – Overview of Artificial Neural Networks, Fuzzy Logic, Evolutionary Computation

UNIT II KNOWLEDGE REPRESENTATION AND REASONING 12

Proposition Logic – First Order Predicate Logic – Unification – Forward Chaining - Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering – Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information – Prolog Programming.

UNIT III UNCERTAINTY **12**

Non monotonic reasoning - Fuzzy Logic - Fuzzy rules - fuzzy inference - Temporal Logic- Temporal Reasoning - Neural Networks - Neuro-fuzzy Inference.

UNIT IV LEARNING **12**

Probability basics – Bayes Rule and its Applications – Bayesian Networks – Exact and Approximate Inference in Bayesian Networks – Hidden Markov Models – Forms of Learning – Supervised Learning – Learning Decision Trees – Regression and Classification with Linear Models – Artificial Neural Networks – Nonparametric Models – Support Vector Machines – Statistical Learning – Learning with Complete Data – Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning

UNIT V INTELLIGENCE AND APPLICATIONS **12**

Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-AIl applications – Language Models – Information Retrieval – Information Extraction – Machine Translation – Machine Learning – Symbol-Based – Machine Learning: Connectionist – Machine Learning.

Total : 60 hours

Text Books:

1. Kumar S., “Neural Networks - A Classroom Approach”, Tata McGraw Hill, 2004.
2. Konar A., “Computational Intelligence: Principles, Techniques and Applications”, Springer Verlag, 2005.
3. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition, Pearson Education / Prentice Hall of India, 2010.

Reference Books:

1. Elaine Rich and Kevin Knight, Artificial Intelligence, Third Edition, Tata McGraw-Hill, 2010.
2. Patrick H. Winston. “Artificial Intelligence”, Third edition, Pearson Edition, 2006.
3. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 2006.
4. Nils J. Nilsson, Artificial Intelligence: A new Synthesis, Harcourt Asia Pvt. Ltd., 2000.

BLOCK CHAIN TECHNOLOGY 4 0 0 4

Course Objective:

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.

Course Outcomes:

CO-1: Stating block chain technologies basics are made possible through learning Distributed Database and various types of database

CO-2: Testing the essential part for block chain technologies starts from cryptographically techniques, which provides a platform for students to understand the terminologies behind block chain.

CO-3: Stating the Mining strategies followed in block chain teach the basic architecture behind the perfect building of block chain for industries.

CO-4: Listing the policy for creating block chain and life of block chain are learned as a basic necessary step in building a block chain technologies.

CO-5: Classifying the limitations and proofs are another essential part of block chain technologies, which are learned for betterment of creating block chain.

CO-6: Describing the history behind the block chain and learning about Vulnerability, Attacks and Side chain gives an additional support for creating a secured block chain.

CO-7: Recognizing some of latest crypto currency aspects leads students to understand some of basic concepts of Black Market and Global Economy

CO-8: Implementing block chain technologies in some of real time applications are also Learned

CO-9: Develop the acquired knowledge in solving the problem in existing case studies.

CO-10: Design a method for solving a problem case study with different perspective

UNIT- I BLOCK CHAIN 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 BLOCKCHA 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 & Hard Fork, Private and Public block chain.

UNIT-III DISTRIBUTED CONSENSUS AND CRYPTOCURRENCY 12

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, 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 CRYPTOCURRENCY 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 CASE STUDY ON BLOCKCHAIN 12

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

Total: 60 Hours

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Crypto currency and Applications', Oxford University Press, 2019.
3. Josh Thompson, 'Block chain: The Block chain for Beginnings, Guild to Block chain Technology and Block chain Programming', Create Space Independent Publishing Platform, 2017.

Reference Books:

1. https://www.blockchainexpert.uk/book/blockchain-book.pdf
2. https://users.cs.fiu.edu/~prabakar/cen5079/Common/textbooks/Mastering_Blockchain_2nd Edition. pdf
3. https://www.gsb.stanford.edu/sites/gsb/files/publication-pdf/study-blockchain-impact-moving- beyond-hype_0.pdf
4. https://www.lopp.net/pdf/princeton_bitcoin_book.pdf
5. https://consensys.net/blockchain-use-cases/
6. https://medium.com/@dejanjovanovic_24152/blockchain-case-studies-2271d37d3ed

CLOUD COMPUTING 4 0 0 4

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

Course Outcomes:

CO-1: To provide students with the fundamentals and essentials of Cloud Computing.

CO-2: Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing

CO-3: Identify the appropriate cloud services for a given application.

CO-4: Analyze Cloud infrastructure including Google Cloud and Amazon Cloud

CO-5: Understand the importance of protocols and standards in computing.

CO-6: Analyze authentication, confidentiality and privacy issues in cloud computing environment.

CO-7: Explore online scheduling such as Event management and project management.

CO-8: Access the cloud database; analyze how to store and share data with privacy.

CO-9: Collaborate cloud with social network and web based communication.

CO-10: Determine financial and technological implications for selecting cloud computing platforms.

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 – Amazon Ec2 – Google App Engine – IBM Clouds.

UNIT III CENTRALIZING EMAIL 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 COLLABORATING 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-BASED COMMUNICATION TOOLS 12

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

Total: 60 Hours

Text Books:

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.
2. Haley Beard, "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, July 2008.

SOFTWARE QUALITY ASSURANCE 4 0 0 4

Course Objective:

This course introduces the basic concepts of Software Quality Control and Assurance with different quality measures and standards for real time software projects as case studies.

Course Outcomes:

CO-1: Learn about Software Quality Management – Quality Factors, components and Plans.

CO-2: To understand Software Quality Metrics and Quality Assurance Standards.

CO-3: To identify the various tools for Testing.

CO-4: To explore the different verification techniques for software development.

CO-5: To understand Software Quality Audits and illustrate Quality frameworks concepts.

CO-6: To highlight the importance of software project management.

CO-7: Learn about Software Quality Assurance Technologies.

CO-8: To gain knowledge about the various Software Testing Coverages.

CO-9: To Understand the Strategic about various quality standards to assess the software. C**O-10:**

Implement the software tools to improve the quality of the project.

UNIT I INTRODUCTION 12

Quality and the quality system - standards and procedures technical activities. Software tasks - management responsibility - quality system - contract review - design control - document control - purchasing product identification and traceability.

UNIT II PROCESS CONTROL 12

Checking - Identification of Testing Tools - Control of Nonconforming Product - Corrective Action- Verification: Verification techniques – Inspections, reviews, walk-throughs – Case studies.

UNIT III QUALITY AUDITS 12

Handling, Storage, Packing And Delivery - Quality Records - Internal Quality Audits - Training - Servicing - Statistical Techniques-Views On Quality – Cost Of Quality - Quality Models – Quality Frameworks – Verification And Validation – Defect Taxonomy – Defect Management – Statistics And Measurements – IEEE Standards – Quality Assurance And Control Processes.

UNIT IV QUALITY ASSURANCE TECHNOLOGIES 12

QA And New Technologies - QA and Human - Computer interface - Process Modeling - Standards And Procedures- Coverages: Block, Conditions, Multiple Conditions, MC/DC, Path – Data Flow Graph – Definition And Use Coverages – C-Use, P-Use, Defclear, Def-Use – Finite State Machines – Transition Coverage.

UNIT V INDIAN STANDARDS **12**

ISO – ISO Standards-Development Process-ISO Certification – ISO Consulting Service And Consultants - E-Business - 9001 - Elements of ISO 9001 - Improving Quality System - Case Study.

Total : 60 hours

Text Books:

1. Claude Y. Laporte, Alain April , "Software Quality Assurance", Wiley-IEEE Computer Society Press, 2018.
2. Watts S. Humphrey, "Managing the software process", Addison Wesley, 1999.
3. Tsum S.Chow, "Software Quality Assurance a Practical Approach", IEEE Computer Society press, 1985.
4. Roger S. Pressman, " Software Engineering - A Practitioner's approach", McGraw Hill, 8th Edition, 2019.

CRYPTOGRAPHY AND ITS APPLICATIONS 4 0 0 4

Course Objective: (Employability)

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.

Course Outcomes:

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

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

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

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

CO-5: To be familiar with advanced security issues and technologies.

CO-6: Will develop their skills in the programming of symmetric and/or asymmetric ciphers and their use in the networks. ·

CO-7: Develop SSL or Firewall based solutions against security threats, employ access Control techniques to the existing computer platforms such as UNIX and Windows NT.

CO-8: Enable the students to develop security algorithms in the network.

CO-9: Identify E-mail-attacks and establishing keys privacy E-Mail attacks.

CO-10: Will learn protocols used in Web Security and Transport layer Security.

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 logarithms.

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 CASE STUDY ON 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. IP Security: 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

Text Books:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of India, 2002.
3. Bernard Menezes,“Network Security and Cryptography”, Cengage Learning,India Edition,2010.
4. Behrouz A.Forouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security”, Tata McGraw Hill Second Edition, 2010.

BIG DATA ANALYTICS 4 0 0 4

Course Objective: (Employability)

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.

Course Outcome:

CO-1: Understand the fundamental concepts of big data platform and know about the basic concepts of nature and evolution of big data.

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

CO-3: Understand the data streams concepts and stream computing.

CO-4: To explore on Big Data real time analytics platform applications.

CO-5: Learn about the advanced analytics techniques to gain knowledge of latest techniques.

CO-6: To understand the k means, naïve, decision tree, time series and text analysis.

CO-7: Learn the fundamental concepts like history and components of Hadoop.

CO-8: Become skilled at analyzing, scaling and streaming of Hadoop.

CO-9: Understand the framework of Visual data analysis techniques, interaction techniques.

CO-10: To learn tips and tricks for Big Data system and application case studies.

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

Text Books:

1. Prajapati, Big Data Analytics with R and Hadoop, 2014
2. Stephan Kudyba, Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications, March 12, 2014.
3. Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author), Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications, 2013

PARALLEL AND DISTRIBUTED COMPUTING SYSTEM 4 0 0 4

Course Objective: 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.

Course Outcome:

CO-1: Able to understand the basic concepts of Parallel computing systems.
CO-2: Provide Knowledge about Cluster Computing systems.
CO-3: Understand about Message Passing Technique.
CO-4: Evaluating Parallel programs and debugging.
CO-5: Understanding of Pipelining Techniques and examples.
CO-6: Able to know about Synchronous Computations.
CO-7: Provides knowledge about programming with shared memory.
CO-8: Able to learn about, load balancing, distributed termination examples.
CO-9: Provides knowledge about Distributed shared memory systems.
CO-10: Able to implement different sorting and numerical 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 PIPELINING TECHNIQUES **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 - Open MP.

UNIT V DISTRIBUTED SHARED MEMORY SYSTEMS: 12

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

Total : 60 hours

Text Books:

1. Barry Wilkinson, Michael Allen, “Parallel Programming”, Pearson Education, 2nd Edition.
2. Jaja, “Introduction to Parallel algorithms”, Pearson, 1992.

Reference Books:

1. Calvin Lin, Larry Snyder, “Principles of Parallel Programming”, Addison-Wesley, 2008.

NEURAL NETWORK 4 0 0 4

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.

Course Outcomes:

CO-1: Able to understand the Architecture of different neural networks.
CO-2: Understand a wide variety of learning algorithms.
CO-3: Understand about supervised learning.
CO-4: Understand about unsupervised learning.
CO-4: Provide understanding of techniques and concepts.
CO-5: Understanding limitations of various learning algorithms.
CO-6: Provide a way to evaluate performance of learning algorithms.
CO-7: Apply the algorithms to a real-world problem, optimize the models learned.
CO-8: Provides knowledge about associative memory networks.
CO-9: Able to implement learning models for real life applications.
CO-10: Able to implement different concepts and algorithms for practical applications.

UNIT I BASIC LEARNING ALGORITHMS 12

Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture:Feedforward and Feedback – Learning Process: Error Correction Learning – Memory Based Learning – Hebbian Learning – Competitive Learning - Boltzman Learning – Supervised and Unsupervised Learning – Learning Tasks: Pattern Space – Weight Space – Pattern Association – Pattern Recognition – Function Approximation – Control – Filtering - Beamforming – Memory – Adaptation - 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-BASIS FUNCTION NETWORKS AND SUPPORT VECTOR

MACHINES RADIAL BASIS FUNCTION NETWORKS 12

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 Non separable 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 12

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model (HME) – Model Selection using a Standard Decision Tree – A Priori and Postpriori 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 – Neuro dynamical Systems – The Cohen - Grossberg Theorem.

UNIT IV ATTRACTOR NEURAL NETWORKS 12

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 ORGANISING MAPS AND PULSED NEURON MODELS 12

Self-Organizing Map – Maximal Eigenvector Filtering – Sanger's Rule – Generalized Learning Law – Competitive Learning - Vector Quantization – Mexican Hat Networks - Self-organizing Feature Maps – Applications - Spiking Neuron Model – Integrate-and-Fire Neurons – Conductance Based Models – Computing with Spiking Neurons.

TOTAL: 60 Hours

Text Books:

1. Nunes Da Silva I, Artificial Neural Networks A Practical Course", SPRINGER, ISBN - 9783319431611, January 2017

2. Satish Kumar, “Neural Networks: A Classroom Approach”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2004.
3. Simon Haykin, “Neural Networks: A Comprehensive Foundation”, 2ed., Addison Wesley Longman (Singapore) Private Limited, Delhi, 2001.

ADVANCED COMPILER DESIGN 4 0 0 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.

Course Outcome:

CO-1: To understand the introduction of compiler and phases of compiler.
CO-2: Explains the concepts of lexical analyzer and Finite Automation.
CO-3: To master the key concepts of context-free grammar.
CO-4: Understand and apply different parsing techniques and construction of syntax tree.
CO-5: To master the advanced features of automatic parsing techniques specifically LR parser, SLR parser.
CO-6: Analze the concepts of construction of LR, SLR parsing table.
CO-7: Explains a syntax directed translation concepts.
CO-8: To understand the concepts of intermediate code generation.
CO-9: Describes code generation algorithm and local code optimization.
CO-10: Explains the steps of code generating algorithm to construct code generator.

UNIT 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 – Capabilities of Context free grammar-Handling errors in Context free grammars-Parsers and Recognizers - Top down and Bottom up Parsing –Grammar analysis Algorithm- Handles – Shift Reduce parsing – Operator precedence parsing – Recursive Descent parsing – Predictive 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.

UNIT V LOWER BOUND ALGORITHM 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

Text Books:

1. V.Aho, Ravi Sheethi, "Compilers-Principles, Techniques and Tools", Pearson Education, 3rd Edition, 2007.
2. David Galles, "Modern Compiler Design", Pearson Education Asia, 2007.

Reference Books:

1. Steven S. Muchnick, "Advanced Compiler Design & Implementation", Morgan Kaufmann Publishers, 2000.
2. C. N. Fisher and R. J. LeBlanc, " Crafting a Compiler with C", Pearson Education, 2000.

MOBILE COMPUTING 4 0 0 4

Course Objective:

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

Course Outcomes:

CO-1: Introduce various wireless systems and standards and their basic operation cases.

CO-2: Learn to model radio signal propagation issues and analyze their impact on communication system performance.

CO-3: To understand how the various signal processing and coding techniques of GSM and its Architecture.

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

CO- 5: To have depth knowledge about various wireless LAN techniques.

CO-6: To learn to simulate wireless networks and analyze the simulation results.

CO-7: To appreciate the contribution of Wireless Communication networks to overall technological growth.

CO-8: To understand the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication networks.

CO-9: To provide the student with an understanding of advanced multiple accesses techniques

CO-10: To provide the student with an understanding of diversity reception techniques

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, Base band 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

Text Books:

1. J. Schiller, “Mobile Communications”, Pearson Education, Delhi, 2nd edition, 2013.
2. Principles of Mobile Computing, Hansmann, Merk, Nicklous, Stober, 2nd Edition, Springer India), 2004.
3. Principle of wireless Networks: A unified Approach, Pahalavan, Krishnamurthy, Pearson Education, Delhi, 2003.
4. Mobile and Wireless Design Essentials, Martyn Mallick,Wiley Dreamtech India Pvt. Ltd., New Delhi, 2004.
5. Wireless Communications and Networks, W.Stallings, 2nd Edition, Pearson Education, Delhi, 2004.

R PROGRAMMING 4 0 0 4

Course Objective

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.

Course Outcome

CO-1: Understand the basics of R programming including matrix and vectors etc.
CO-2: Recognize and make appropriate use of different types of data structures.
CO-3: Identify and implement appropriate control structures to solve a particular programming problem.
CO-4: Design and write functions in R and implement simple iterative algorithms.
CO-5: Write functions including generic functions using various methods and loops.
CO-6: Install various packages and work effectively in the R environment.
CO-7: Become proficient in writing a fundamental program and perform analytics with R.
CO-8: To know how to work with files in R.
CO-9: To study about data visualization and data management techniques.
CO-10: Use R to create sophisticated figures and graphs.

UNIT I INTRODUCTION TO R 12

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 12

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

UNIT III PACKAGES AND RESHAPING 12

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 R OBJECTS CLASS 12

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 AND DATA MANAGEMENT 12

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.

Text Books:

1. Norman Matloff , "The Art of R Programming-a tour of statistical software design", William Pollock, 2011.
2. Paul Teetor "R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics", O'Reilly Cookbooks, O'Reilly Media , 2011.

Reference Books:

1. Rob Kabacoff, "R in Action Book", Manning Publications Co, 2011.
2. Nina Zumel , John Mount , Jim Porzak, "Practical Data Science with R", Dreamtech, 2014.
3. Richard Cotton, "Learning R: A Step-by-Step Function Guide to Data Analysis", O'Reilly Media, 2013.

ARTIFICIAL INTELLIGENCE 4 0 0 4

Course Objective:

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.

Course Outcomes:

CO-1: Understand the Future of Artificial Intelligence and cyber security.

CO-2: Analyze the different Problem Solving Approaches.

CO-3: Evaluate the security issues of web applications, services and severs.

CO-4: Analyze software agents and applications.

CO-5: Assess different Cyber Security Vulnerabilities.

CO-6: Learn types of safeguard methods.

CO-7: Illustrate the methods and tools used for cybercrime investigation.

CO-8: Design an approach to prevent cybercrime offenses.

CO-9: Apply the knowledge to discuss about existing case studies.

CO-10: Design a method to solve a problem in different perspective.

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 AND SAFEGUARDS 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 Policy 2013.

Total: 60 Hours

Text Books

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, 2010.
2. James Graham, Richar Howard,Ryan Olson, “Cyber Security Essentials”, CRC Press, Tailor and
3. Francis Group, 2011.
4. Nina Godbole, Sunit Belapur, “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Publications, April, 2011.
5. https://www.cyberralegalservices.com/detail-casestudies.php.

EMBEDDED SYSTEM 4 0 0 4

Course Objective

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.

Course Outcome

CO-1: Able to understand the 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: Provide understanding of General Purpose and Domain Specific Processors.

CO-6: Understanding about Embedded Firmware.

CO-7: Provides knowledge about Embedded Firmware Design Approaches and Development Languages.

CO-8: Able to learn about RTOS Based Embedded System Design.

CO-9: Provides knowledge about associative memory networks.

CO-10: Able to implement different concepts and algorithms for practical applications.

UNIT I INTRODUCTION TO EMBEDDED 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 TYPICAL EMBEDDED SYSTEM: 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 EMBEDDED SYSTEM DESIGN 12

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

UNIT V TASK COMMUNICATION 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

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.

SECURITY ISSUES IN MACHINE LEARNING 4 0 0 4

Course Objective:

This course introduces the basic concept of machine learning, types of machine learning, security issues and possible solutions to ensure machine learning security, advanced learning techniques and case study on machine learning.

Course Outcomes:

CO-1: To understand the concepts of machine learning.

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

CO-3: To understand the classification and regression algorithm techniques.

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

CO-5: To appreciate the concepts and algorithms of reinforcement learning

CO-6: To understand the security issues in machine learning.

CO-7: To understand the possible solutions to ensure machine learning security.

CO-8: To learn aspects of computational learning theory.

CO-9: To appreciate the concepts and algorithms of reinforcement learning

CO-10: To learn possible case studies in machine learning

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 Bayes Theorem, 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 NetworksLearning 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, Temporal Difference Learning Exploration.

UNIT V CASE STUDY **12**

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

Total: 60 Hours

Text Books:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. EthemAlpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
2. Stephen Marsland, “Machine Learning - An Algorithmic Perspective”, Chapman and Hall/CRC Press, Second Edition, 2014.

General Electives

HUMAN RESOURCE MANAGEMENT 4 0 0 4

Course Objective

To teach relevant, practical and applicable human resource management skills to equip the student with the foundation competencies for working as HR practitioners in business. To highlight the important challenges facing managers and employees in today's business climate. To introduce contemporary theory and practice in modern human resource management and the range of tools and methods available to address HR challenges and problems.

Course Outcome

CO-1: Discuss the History and evolution of HRM.

CO-2: Explain the importance of HRM in the organizations through their Roles and responsibilities, challenges etc.

CO-3: Assess the major HRM functions and processes of HRM planning, job analysis and design, recruitment, selection, training and development, compensation and benefits, and performance appraisal.

CO-4: Identify strategic HR planning and the HRM process to the organization's strategic management and decision making process.

CO-5: To explain how training helps to improve the employee performance.

CO-6: Debate the concept of career development and various career stages.

CO-7: Compare the difference between coaching and mentoring.

CO-8: Analyze the emerging trends, opportunities and challenges in performance appraisal.

CO-9: Apply the Concept of job application and how it is practically applied in the organization.

CO-10: Restate various recent techniques related to HRM.

UNIT I HUMAN RESOURCE MANAGEMENT 12

Meaning - Scope & Objectives of HRM - Evolution of HRM - Difference between PM & HRM - HRM function's - HR as a Strategic Business Partner - HR Policy & procedures - Competitive challenges influencing HRM Qualities & qualification of HR Manager - Roles and Responsibilities of HR Manager / Departments.

UNIT II HUMAN RESOURCE PROCESS **12**

Human Resource Planning – Job Analysis and Design - Recruitment - Selection and placement process – Types of interviews – Placement - Orientation & Induction - Determining training needs - Training Approaches - Separation process & Exit interview.

UNIT III MANAGING CAREERS **12**

Career Development vs. Employee development - Career stages – Career Choices and Preferences - Mentoring and Coaching - Time Management.

UNIT IV PERFORMANCE MANAGEMENT **12**

Purposes of Performance Management - Performance Appraisal Methods - Punishment and Promotion, Job evaluation - Wage & Salary administration – Concepts - Pay structure - Incentives – Bonus - Insurance.

UNIT V CONTEMPORARY ISSUES IN HRM **12**

Talent Management - Competency Mapping - Industrial Relations – Health & Safety issues - grievance handling - D Work Life Balance - Quality of Work Life - HRD in India - International HRM.

Total: 60 Hours

Text Books:

1. Aswathappa.K, “Human Resource Management, Text and Cases”, Tata McGraw Hill, New Delhi, 2014.
2. Gupta. S.C, “Advanced Human Resource Management, Strategic Perspective”, ANE Books Pvt. Ltd, New Delhi, 2009.

Reference Books:

1. Angela Baron and Michael Armstrong, “Human Capital Management (Achieving Added Value Through People)”, Kogan Page Limited, United States, 2007.
2. Anuradha Sharma and Aradhana Khandekar, “Strategic Human Resource Management”, Response Books, New Delhi, 2006.
3. Beer et al, “Managing Human Assets”, The Free Press: Maxwell Mac Millan Inc, New York, 1984.
4. Dreher Dougherty, “Human Resource Strategy: A behavioral perspective for the General Manager”, McGraw – Hill Higher Education, Singapore, 2001.

SOCIAL NETWORKING 4 0 0 4

Course Objective

The Students should be able to understand the concept of sematic web and related applications by acquiring adequate knowledge from ontology. The students will also be able understand the human behavior in social web and visualizing the social networks.

Course Outcome

CO-1: Students be able to understand the basic knowledge's and limitations of semantic web.

CO-2: Electronic sources for network analysis, various information's about blogs and online communities can be learned.

CO-3: Ontology based semantic web modelling and aggregation for social network can be deeply grasped by students.

CO-4: Students can acquire adequate knowledge in aggregating and reasoning with social network data in advance representation.

CO-5: Basic knowledge about web social networks with detailed extraction evolution of web communities can be learned.

CO-6: Students can able to know various applications of community mining algorithms with tools for detecting social network infrastructures.

CO-7: Students can understand behavioral patterns followed by humans in social communities and concepts about trust network analysis in reality mining

CO-8: Trust derivation based on trust comparison can be learned with deep knowledge in spectrum attack and counter measures.

CO-9: Students can gather knowledge about visualizing the analyzed semantic web with various visualizing technologies.

CO-10: Students can able to understand various applications and theories available for social networks visualization.

UNIT 1 INTRODUCTION **12**

Introduction to Semantic Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 12

Ontology and their role in the Semantic Web - Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 12

Extracting evolution of Web Community from a Series of Web Archive –Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 12

Understanding and predicting human behavior for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and counter measures.

UNIT 5 VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 12

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-citation networks.

Total: 60 Hours

Text Books:

1. Peter Mika, “Social Networks and the Semantic Web”, Ist Edition, Springer 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1st Edition, Springer, 2010.

Reference Books:

1. Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, 1st Edition Springer, 2011.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.
4. John G. Breslin, Alexandre Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

GEOGRAPHICAL INFORMATION SYSTEM 4 0 0 4

Course Objective

GIS is a combination of software and hardware with capabilities for manipulating, analyzing and displaying spatially-referenced information. By linking data to maps, a GIS can reveal relationships not apparent with traditional item-referenced information systems and data base management products, and by displaying information in a graphic form can communicate complex spatial patterns succinctly. The course emphasizes the concepts needed to use GIS correctly and effectively for manipulating, querying, analyzing, and visualizing spatial-based data.

Course Outcome:

CO-1: Understand the fundamental concepts of geographic information systems and their differences from other types of information systems.

CO-2: Able to understand the basic necessary to work with GIS.

CO-3: Utilize modern industry-standard GIS software for conducting basic GIS analyses and producing cartographic output.

CO-4: predominantly using ESRI's ArcGIS software .

CO-5: Gain critical thinking skills in solving geospatial problems.

CO-6: Understand competency with the ArcMap software to enhance and interpret data.

CO-7: Develop and execute a project requiring GIS as a management, analytical, and visualization tool

CO-8: Identify and accessing publicly available data sets.

CO-9: Learn queries in GIS Analysis Formulate applications of GIS technology.

CO-10: Use GIS to identify, explore, understand, and solve spatial problems.

UNIT I INTRODUCTION TO GIS 12

What is GIS - What GIS can do - Types of GIS projects - Remote sensing, GPS, SDSS Continental Drift – Representing Geography - Geographic Representations - Nature of Geographic Data - Spatial Autocorrelation - Spatial Sampling - Georeferencing - Global Navigation Systems.

UNIT II CREATING, MAINTAINING AND USING GEOGRAPHIC DATABASES 12

GIS Data Collection and Correction - Geographic Databases - Accessing Geographic Data - Distributed GIS- Geographic Data Analysis : Geovisualization - Vectors and Rasters - Measurement and Transformation- Uncertainty in GIS - ArcGIS : Exploring ArcGIS - Spatial Data - Metadata - ArcCatalog - ArcToolbox.

UNIT III WORKING WITH ARCMAP 12

Map documents - Windows and Menus - Help system - Data frames – Layers - Symbols and styles - Map scales and labeling - Coordinate Systems and Map Projections - Map projections and GIS - Coordinate Systems - Spheroids and datums - Common projection systems - Projecting data. Basic Editing in ArcMap : Editing overview - The Editor Toolbar Snapping features - Creating adjacent polygons - Editing features - Editing attributes - Saving work.

UNIT IV COORDINATE SYSTEMS AND MAP PROJECTIONS 12

Map projections and GIS - Coordinate Systems - Spheroids and datums - Common projection systems - Projecting data - Drawing and Symbolizing Features - Types of maps Classifying numeric data - Using map layers - Editing symbols and using styles - Displaying rasters.

UNIT V WORKING WITH TABLES 12

Tables - Joining tables - Statistics - Summarizing tables - Editing and calculating tables - Queries - What are queries - Selecting - Using queries in GIS analysis - Spatial Joins - Types of joins - Setting up a spatial join - Spatial Data Modeling: Types of Models - Tools for Modeling – Future GIS – Case study with GIS.

Total: 60 hours

Text Books

1. Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind, " Geographic Information Systems and Science", 4th Edition, John Wiley & Sons, 2012.
2. O'Sullivan, D. and D. Unwin , "Geographic Information Analysis", 2nd Edition, John Wiley and Sons, 2010.

Reference Books:

1. Longley, Goodchild, Maguire, Rhind, " Geographic Information Systems and Science", 2nd Edition, Wiley, 2005.
2. Gorr, W and Kurland K. " GIS Tutorial: Workbook for ArcView 9", ESRI Press, 2005.

TECHNICAL WRITING IN COMPUTER SCIENCE 4 0 0 4

Course Objectives:

This course is designed to develop skills that will enable to produce clear and effective scientific and technical documents. While the emphasis will be on writing, oral communication of scientific and technical information will form an important component of the course, as well.

Course Outcomes:

CO-1: To understand basic concepts of technical writer**.**

CO-2: To learn research, article, development, tools and publication.

CO-3: To covers issues related to workplace research that you will have to conduct as a technical writer**.**

CO-4: The module focuses on audience, purpose, and measures of excellence in technical documents.

CO-5: To provides general guidelines for using graphical tools that you can use to design visuals with the output process of the report in mind

CO-6: To use visuals to communicate a large amount of information quickly and efficiently.

CO-7: To develop an enhanced understanding of such types of technical documentation as feasibility and recommendation reports, instructions as well as laboratory research.

CO-8: Itcovers issues related to various types of academic and workplace research.

CO-9: To understand the guidelines, manual, Design specification and help.

CO-10: To learn the proposal writing, Business Development Perspective, Reports.

UNIT I INTRODUCTION **12**

Foundation of Reading & Writing - Introduction to Technical Writing- Introduction to research papers - articles, technical notes - Document Development Life Cycle - Software Tools (Latex, etc.) - concept of technical publication

UNIT II KNOWLEDGE ABOUT TECHNICAL WRITING **12**

Documentation development life cycle: Role of a Technical writer- Principles of Technical Writing, Documentation deliverables - Printed documentation and Online Help Systems - Working with images and illustrations -Characteristics of Technical Writing - Measures of Excellence in Technical Documents - The Content Approach - Acquiring the Three Types of Knowledge - Understanding Audience and Purpose - Collaborative Writing - Writing for Multiple Audiences

UNIT III ORGANIZING THE INFORMATION **12**

Introduction – Visuals - Technical definition – Extensions - Mechanism Description - Mechanism in Operation - Planning Stage - Technical Writing Process: Document development process - Estimating Technical Documentation - Documentation Planning - Selection of Tools - Information Architecture - Templates and Page design - Audience Profiling Task Analysis - Content Development - Elements of Style - Technical Reviews - Editorial Reviews - Formatting and pagination - Document Conversions - Content Publishing - Quality Control - Content Maintenance

Unit IV RESEARCHING YOUR SUBJECT **12**

Academic vs. Workplace Research - Conducting Secondary Research - Primary Research - Focus on Process - Laboratory Report - Feasibility, recommendation, and evaluation reports – Instructions - Checklist for the technical report - Style of writing -Grammar and Editing English Grammar - Punctuation and Mechanics - MS Style Guides & Proof Reading

UNIT V CASE STUDY **12**

Design Specification, User Manual / Guides, Hardware Manuals, Installation Manuals, Online Help, Web sites, Analytical/Feasibility Reports, Proposals (Business Development Perspective), Lab/ScienceR eports, Project proposal writing, Abstracts, Progress reports.

Text Books:

1. Markel, Mike. Technical Communication. 7th ed. New York, NY: Bedford/St. Martin's, 2003.ISBN: 9780312403386.

2. Diana. A Pocket Style Manual. 4th Ed. New York, NY: Bedford/St. Martin's, 1999. ISBN: 9780312406844.

3. Perelman, Leslie C., James Paradis, and Edward Barrett. The Mayfield Handbook of Technical and Scientific Writing. New York, NY: McGraw-Hill, 1997. ISBN: 9781559346474.