PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM-636011

DEGREE OF BACHELOR OF SCIENCE

Syllabus for

B.Sc., COMPUTER SCIENCE (ARTIFICIAL INTELLIGENCES AND DATA SCIENCE)

(SEMESTER PATTERN- CBCS)

(For Candidates admitted in the colleges affiliated to

Periyar university from 2023-2024 onwards)

1. Introduction

B.Sc. Computer Science (Artificial Intelligence and Data Science)

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer

Artificial intelligence (AI) is the ability of machines to replicate or enhance human intellect, such as reasoning and learning from experience. Artificial intelligence has been used in computer programs for years, but it is now applied to many other products and services. For example, some digital cameras can determine what objects are present in an image using artificial intelligence software. In addition, experts predict many more innovative uses for artificial intelligence in the future, including smart electric grids.

AI uses techniques from probability theory, economics, and algorithm design to solve practical problems. In addition, the AI field draws upon computer science, mathematics, psychology, and linguistics. Computer science provides tools for designing and building algorithms, while mathematics offers tools for modeling and solving the resulting optimization problems.

2. Programme Outcomes (PO) of B.Sc. degree programme in Computer Science Artificial Intelligence and Data Science

- Scientific aptitude will be developed in Students
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modelling and solving real life problems.
- Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.

The above expectations generally can be pooled into 6 broad categories and can be modified according to institutional requirements:

PO1: Knowledge

PO2: Problem Analysis

PO3: Design / Development of Solutions

PO4: Conduct investigations of complex problems

PO5: Exhibit good **domain knowledge** and completes the assigned tasks Effectively and efficiently in par with the expected quality standards.

PO6: Apply **analytical and critical thinking**toidentify, formulate, analyze and solve Complex problems in order to reach authenticated conclusions

3. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science Artificial Intelligence and Data Science

PSO1: Graduates should be able to evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains for Artificial Intelligence and Data Science

PSO2: Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve . Problems in mathematics or statistics and realtime application related sciences.

PSO3: Demonstrate the ability to create innovative solutions from idea to product, applying Scientific methods and tools

PSO4: Provide innovative ideas to instigate new business ventures in the hospitality industry

PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer Science and Industrial statistics.

PSO6: Apply the technical and critical thinking skills in the discipline of artificial Intelligence and Data Science to find solutions for complex problems.

PSO7: Equip with Computer science technical ability, problem solving skills, creative talent and power of communication necessary for Various forms of employment.

PSO8: To collect requirements, analyze, design, implement and test software Systems.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids:(put tick mark in each row)

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

4. Highlights of the Revamped Curriculum

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Computer Science based problem solving skills are included as mandatory components in the ‗Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest – Statistics with R Programming, Data Science, Machine learing. Internet of Things and Artificial Intelligence etc..

5. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background • Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors

IV	Industrial Statistics	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
IV	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; _Mathematics for Advanced Explain' component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers; • _Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: **For Advanced Learners / Honors degree**		• To cater to the needs of peer learners / research aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Credit Distribution for UG Programmes

Sem I	Credit	Hour	Sem II	Credit	Hour	Sem III	Credit	Hour	Sem IV	Credit	Hour	Sem V	Credit	Hour	Sem VI	Credit	Hour
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC -XII	4	5	6.4 Elective - VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course – SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours

First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses [in Total]	13	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
Total		**23**	**30**

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
Total		**23**	**30**

Second Year
Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
Total		**22**	**30**

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	13
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
Total		**25**	**30**

Third Year-Semester-V

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based	22	26
Part-4	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	2
Total		**26**	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	18	28
Part-4	Extension Activity	1	-
	Professional Competency Skill	2	2
Total		**21**	**30**

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	1	22
Part V	-	-	-	-	-	2	2
Total	23	23	22	25	26	21	**140**

***Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

Illustration for B.Sc. Computer Science (AI&DS) Curriculum Design

First Year

Semester-I

Part	Paper Code	List of Courses	Credit	Hours per week (L/T/P)
Part-I		Language – Tamil	3	6
Part-II		English	3	6
Part-III	23UADCC01	CC1-Data Structures	5	5
	23UADCCP01	CC2- Practical:Computer Programming Lab	3	3
		Elective Course -EC1 (Generic / Discipline Specific) –Choose from Annexure I	5	6
Part-IV		Skill Enhancement Course- SEC1 (Non Major Elective)	2	2
		Foundation Course FC – Fundamentals of Computer Programming	2	2
Total			**23**	**30**

Semester-II

Part	Paper Code	List of Courses	Credit	Hours Per week (L/T/P)
Part-I		Language -Tamil	3	6
Part-II		English	3	4
Part-II	NMSDC	Language Proficiency for Employability- Overview of English Communication	2	2
Part-III	21UADCC02	CC3 –Introduction on python	5	5
	21UADCCP02	CC4 –Practical: Python Programming Lab	3	3
		Elective Course - EC2 (Generic / Discipline Specific) –Choose from Annexure I	5	6
Part-IV		Skill Enhancement Course -SEC2 (Non Major Elective)	2	2
		Skill Enhancement Course - SEC3 Choose from Annexure II	2	2
Total			**25**	**30**

Second Year
Semester-III

Part	Paper Code	List of Courses	Credit	Hours Per week (L/T/P)
Part-I		Language - Tamil	3	6
Part-II		English	3	6
Part-III	23UADCC03	CC5-Foundation of Artificial intelligence	4	4
	23UADCCP03	CC6-Practical: Internet Programming Lab	3	3
		Elective Course- EC3 (Generic / Discipline Specific) -Choose from Annexure I	6	6
Part-IV	NMSDC	Computational Skills for Employability	2	2
		Skill Enhancement Course -SEC5 Choose from Annexure II	2	2
		Environmental Studies	-	1
Total			**23**	**30**

Semester-IV

Part	Paper Code	List of Courses	Credit	Hours Per week (L/T/P)
Part-I		Language - Tamil	3	6
Part-II		English	3	6
Part-III	23UADCC04	CC7-Fundamental of Data Science	4	4
	23UADCCP04	CC8-Practical: Database Programming Lab	3	3
		Elective Course - EC4 (Generic / Discipline Specific) Choose from Annexure I	6	6
Part-IV		Skill Enhancement Course - SEC6 Choose from Annexure II	2	2
		Skill Enhancement Course - SEC7Choose from Annexure II	2	2
		Environmental Studies	2	1
Total			**25**	**30**

Third Year

Semester-V

Part	Paper Code	List of Courses	Credit	Hours Per week (L/T/P)
Part-III	23UADCC05	CC9 –Ethics of Artificial intelligence	4	5
	23UADCC06	CC10 - Database Design and management	4	5
	23UADCCP05	CC11 - Practical: Data Science Lab	4	5
		Elective Course - EC5 (Discipline Specific) Choose from Annexure I	3	4
		Elective Course – EC6 (Discipline Specific) Choose from Annexure I	3	4
	23UADCCPR1	CC12 - Project with Viva voce	4	5
Part-IV		Value Education	2	2
		Internship / Industrial Training(Summer vacation at the end of IV semester activity)	2	
Total			**26**	**30**

Semester-VI

Part	Paper Code	List of Courses	Credit	Hours per week (L/T/P)
Part-III	23UADCC07	CC13 -Robotic Process Automation	4	6
	23UADCC08	CC14- Natural Language Processing	4	6
	23UADCCP06	CC15-Practical:Programming in UI Path Automation Lab	4	6
		Elective Course – EC7 (Discipline Specific) Choose from Annexure I	3	5
		Elective Course – EC8 (Discipline Specific) Choose from Annexure I	3	5
Part-IV		Skill Enhancement Course - SEC8Choose from Annexure II	2	2
Part -V		Extension Activity	1	
Total			**21**	**30**

Total Credits: 140

SUGGESTED CORE COMPONENTS

S.No	Paper Code	Paper Title
1	23UADCC09	Programming in C
2	23UADCCP07	Programming in C Lab
3	23UADCC10	Object oriented Programming using C++
4	23UADCCP08	Object oriented Programming using C++ Lab
5	23UADCC11	Mobile Application Development
6	23UADCCP09	Mobile Application Development Lab
7	23UADCC12	Data Analytics using R
8	23UADCCP10	Data Analytics using RLab
9	23UADCC13	Machine Learning
10	23UADCCP11	Machine Learning Lab
11	23UADCC14	Data Mining and Warehousing
12	23UADCC15	Software Metrics
13	23UADCC16	Network Security

Annexure – I

Elective Course (EC1- EC8) (Generic / Discipline Specific

Generic Specific

S.No	Paper Title
1	Mathematics-I
2	Mathematics-II
3	Mathematics Practical
4	Discrete Mathematics-I
5	Discrete Mathematics-II
6	Numerical Methods
7	Optimization Techniques
8	Introduction to Linear Algebra
9	Graph Theory and its Application
10	Numerical Methods-I
11	Numerical Methods-II
12	Statistical Methods and its Application-I
13	Statistical Methods and its Application-II
14	Statistical Practical
15	Physics-I
16	Physics Practical-I
17	Physics-II
18	Physics Practical-II
19	Digital Logic Fundamentals
20	Nano Technology
21	Resource Management Techniques and more

Discipline Specific

S.No	Paper Code	Paper Title
1	23UADE01	Analytics for Service Industry
2	23UADE02	Cryptography
3	23UADE03	Big Data Analytics
4	23UADE04	RDBMS with PL/SQL
5	23UADE05	IOT and its Applications
6	23UADE06	Software Project Management
7	23UADE07	Image Processing
8	23UADE08	Human Computer Interaction
9	23UADE09	Fuzzy Logic
10	23UADE10	Artificial Intelligence
11	23UADE11	Robotics and its Applications
12	23UADE12	Computational Intelligence
13	23UADE13	Grid Computing
14	23UADE14	Cloud Computing
15	23UADE15	Artificial Neural Network
16	23UADE16	Introduction to Data Science
17	23UADE17	Agile Project Management
18	23UADE18	Virtual Realityand more
19	23UADE19	Data Analytics
20	23UADE20	Cognitive Science and Analysis
21	23UADE21	Internet of Things
22	23UADE22	Data Visualization

[Pl. Note:In Semester-VI - For EC7 and EC8 subjects Instructional hours may be used as: 5 per cycle]

Annexure II

Skill Enhancement Course (SEC1-SEC8)

S.No	Paper Code	Paper Title
1	23UADSE01	Fundamentals of Information Technology
2	23UADSE02	Introduction to HTML
3	23UADSE03	Web Designing
4	23UADSE04	PHP Programming
5	23UADSE05	Software Testing
6	23UADSE06	Understanding Internet
7	23UADSE07	Office Automation
8	23UADSE08	Quantitative Aptitude
9	23UADSE09	Multimedia Systems
10	23UADSE10	Advanced Excel
11	23UADSE11	Biometrics
12	23UADSE12	Cyber Forensics
13	23UADSE13	Pattern Recognition
14	23UADSE14	Enterprise Resource Planning
15	23UADSE15	Simulation and Modelling
16	23UADSE16	Internet Basics Laboratory
17	23UADSE17	Internet Programming Lab

[Pl. Note: In Semester-VI - For EC7 and EC8 subjects
Instructional hours may be used as: 5 per cycle]

FIRST SEMESTER

CORE PAPER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
CC1	**Data Structures**	**Core**	5	-	-	-	4	25	75	100

Learning Objectives	
LO1	Understand the concept of abstract data types
LO2	Analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications.
LO3	Demonstrate the concept of trees and its applications
LO4	Design, implement and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting
LO5	Enhance the knowledge to solve problems as graph problems and implement efficient graph algorithms to solve them

UNIT	**Contents**	**No. of Hours**
I	**Abstract Data Types (ADTs)** – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying. Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms.	**15**
II	**Linear Structures**- List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues	**15**
III	**Sorting and Searching**-Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency	**15**
IV	**Tree Structures -** Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi-way search trees.	**15**
V	**Graph Structures**- Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees.	**15**
	TOTAL HOURS	**75**

Course Outcomes		Programme Outcomes
CO	Understand the concept of abstract data types	
CO1	Analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Demonstrate the concept of trees and its applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Design, implement and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Enhance the knowledge to solve problems as graph problems and implement efficient graph algorithms to solve them	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Ellis Horowitz, Sartaj Shani, Data Structures, Galgotia Publication.	
2	Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, Computer Algorithms, Galgotia Publication.	
3	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, ―Data Structures & Algorithms in Python‖, John Wiley & Sons Inc., 2013	
4	Lee, Kent D., Hubbard, Steve, ―Data Structures and Algorithms with Python‖ Springer Edition 2015	
5	Aho, Hopcroft, and Ullman, ―Data Structures and Algorithms‖, Pearson Education, 1983	
Reference Books		
1.	Jean-Paul, Tremblay & Paul G .Sorenson , An Introduction to Data structures with Applications Tata McGraw Hill Company 2008, 2ndEdition.	
2.	Samanta.D , Classic Data Structure Prentice Hall of India Pvt Ltd 2007, 9th Edition	
3.	Seymour Lipschutz, Data Structures McGraw Hill Publications, 2014, 1st Edition	
4.	Rance D. Necaise, ―Data Structures and Algorithms Using Python‖, John Wiley & Sons, 2011	
5.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, ―Introduction to Algorithms", Second Edition, McGraw Hill, 2002.	
Web Resources		
1.	https://www.geeksforgeeks.org/data-structures/	

2.	https://www.tutorialspoint.com/data_structures_algorithms/index.htm
3.	https://techdevguide.withgoogle.com/paths/data-structures-and-algorithms/
4.	https://www.freecodecamp.org/news/learn-data-structures-and-algorithms/
5.	https://www.worldscientific.com/worldscibooks/10.1142/5256#t=aboutBook

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	3	2	2	3	2
CO 3	3	3	2	2	3	2
CO 4	3	3	2	3	2	2
CO 5	3	3	2	3	2	3
Weightage of course contributed to each PSO						

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
CC2	COMPUTER PROGRAMMING LAB	**Core**	-	-	4	-	4	25	75	100

Learning Objectives

LO1	Apply the various basic programming constructs like decision making statements. Looping statements ,functions, concepts like overloading, inheritance ,polymorphism ,virtual functions , constructors and destructors.
LO2	IllustratetheconceptofVirtualClasses,inlinefunctionsandfriendfunctions
LO3	Comparethevariousfilestreamclasses;filetypes, usage of templates and exception Handling mechanisms..
LO4	Comparetheprosandconsofprocedureorientedlanguagewiththeconceptsofobject Oriented language.
LO5	Be able to read and write files in Programming

LAB EXERCISES	Required Hours
1. Write a C program to find the sum, average, standard deviation for a given set of numbers. 2. Write a C program to generate n prime numbers. 3. Write a C program to generate Fibonacci series. 4. Write a C program to sort the given set of numbers in ascending order. 5. Write a C program to count the number of Vowels in the given sentence. 6. Write a C++ Program to create class, which consists of EMPLOYEE Detail like E_ Number, E_ Name, Department, Basic, Salary, Grade. Write a member function to get and display them. 7. writeC++Program to create class SHAPE which consists of two virtual functions 8.WriteaC++Program using function overloading to read two matrices of different DataTypes Such as integers and floating point numbers. 9. Write a C++ Program to create a File and to display the contents of that file with line numbers. 10. Write a C++ Program to merge two files into a single file.	**60**

Course Outcomes	
On completion of this course, students will	
CO1	Apply the various basic programming constructs like decision making statements. Looping statements ,functions, concepts like overloading, inheritance ,polymorphism ,virtual functions , constructors and destructors
CO2	IllustratetheconceptofVirtualClasses,inlinefunctionsandfriendfunctions
CO3	Identify suitable programming constructs for problem solving.
CO4	Comparethevariousfilestreamclasses;filetypes,usageoftemplatesandexception Handling mechanisms..
CO5	Comparetheprosandconsofprocedureorientedlanguagewiththeconceptsofobject Oriented language

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	15	13	15	13	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
FC	Fundamentals of Computer Programming	FC	2	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	To impart knowledge about Computer fundamentals
LO2	To understand the concepts and techniques in C Programming
LO3	To equip and indulge themselves in problem solving using C
LO4	TointroduceheconceptsofObjectOrientedProgrammingParadigm inC++
LO5	Understand about operating system and their uses

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction to C -** Introduction to C 12 Hours Overview of C - Introduction - Character set - C tokens - keyword & Identifiers - Constants - Variables - Data types - Declaration of variables - Assigning values to variables - Defining Symbolic Constants - Arithmetic, Relational, Logical, Assignment, Conditional, Bitwise, Special, Increment and Decrement operators - Arithmetic Expressions - Evaluation of expression - precedence of arithmetic operators - Type conversion in expression – operator precedence & as sociativity - Mathematical functions - Reading & Writing a character - Formatted input and output.	**6**
II	**Decision Making , Looping and Arrays-**Decision Making and Branching: Introduction – if, if….else, nesting of if …else statementselse if ladder – The switch statement, The ?: Operator – The go to Statement. Decision Making and Looping: Introduction- The while statement- the do statement – the for statement-jumps in loops. Arrays – Character Arrays and Strings	**6**
III	**C++-**Introduction toC++-key concept s of Object-oriented Programming–Advantages–ObjectOriented Languages–I/O in C++-C++Declarations. Functions in C++-inline functions– Function Overloading. Classesand Objects: Declaring Objects–Defining MemberFunctions– Static Member variablesand functions–array of objects–friend functions–Overloading member functions– Bitfields and classes –Constructor and destructor with static members.	**6**
IV	**Inheritance -** Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion –	**6**

	Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid ,Multipath inheritance –Virtual base Classes– Abstract Classes.	
V	**Pointers & Files -** Pointers–Declaration–Pointer to Class,Object–this pointer–Pointers to derived classes and Base classes–Arrays–Characteristics–array of classes. Files–File stream classes–file modes–Sequential Read/Write operations–Binary and ASCII Files –Random Access Operation–Templates–Exception Handling– Miscellaneous functions.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO 1	Learn about the Computer fundamentals and the Problem solving and understand the basic concepts of C and C++ programming	
CO2	Demonstrate the various basic programming constructs like decision making statements. Looping statements and functions.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Analyze the object oriented concepts like overloading, inheritance ,polymorphism, Virtual functions ,constructors and destructors.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Comparethevariousfilestreamclasses;filetypes,usageoftemplatesand exception Handling mechanisms, pros and cons of procedure oriented language with the concepts of programming language	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Study about Numeric data and character-based data. Analyze about Arrays.	PO1, PO2, PO3, PO4, PO5, PO6
CO6	Developprogramsincorporatingtheprogrammingconstructsofobjecto riented Programming concepts	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	1. E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008
2	Ashok N Kamthane ,Object-Oriented Programming with Ansi and Turbo C++,Pearson Education,2003.

Web Resources

1.	https://www.tutorialspoint.com/computer_programming/computer_programming_basics.htm
2.	https://www.educative.io/answers/what-are-the-basic-fundamental-concepts-of-programming
3.	https://www.geeksforgeeks.org/basics-of-computer-programming-for-beginners/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	2	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	14	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Semester II

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
CC3	Introduction to Python Programming	Core	5	-	-	-	4	5	25	75	100
Learning Objectives											
LO1	To know the basics of algorithmic problem solving with read and write simple Python programs										
LO2	To develop Python programs with conditionals and loops										
LO3	To define Python functions and call them										
LO4	To use Python data structures - lists, tuples , dictionaries and fix input/output with files in Python.										
LO5	To understand various sorting and searching										
UNIT	**Contents**										**No. of Hours**
I	Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).										15
II	Python interpreter and interactive mode, values and types: int, float, boolean, string and list; variables, expressions, statements, tuple assignment, precedence of operators, comments, modules and functions,										15

	function definition and use, flow of execution, parameters and arguments.	
III	Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else). Iteration: state, while, for, break, continue, pass. Fruitful functions: return values, parameters, local and global scope, function composition, recursion. Strings: string slices, immutability, string functions and methods, string module, Lists as arrays..	15
IV	Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters. Tuples: tuple assignment, tuple as return value, Dictionaries: operations and methods, advanced list processing - list comprehension..	15
V	Files and exception: text files, reading and writing files, format operator, command line arguments, errors and exceptions, handling exceptions, modules, packages.	15
	Total	**75**

Course Outcomes		**Programmeme Outcome**
CO	Develop algorithmic solutions to simple computational problems	
CO1	Read, write, execute by hand simple Python programs. Structure simple Python programs for solving problems.	PO1,PO6
CO2	Decompose a Python program into functions	PO2
CO3	Describe the hash function and concepts of collision and its resolution methods	PO2,PO4
CO4	Represent compound data using Python lists, tuples, dictionaries. Read and write data from/to files in Python Programs	PO4,PO6
CO5	Judge the pros and cons of Python	PO5,PO6

Text Book

1	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‟‟, 2nd edition, Updated for Python 3, Shroff/O‟‟Reilly Publishers, 2016.
2	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011

Reference Books

1.	John V Guttag, ―Introduction to Computation and Programming Using Python‟‟, Revised and expanded Edition, MIT Press, 2013
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016
3	Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015
4	Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5	Charles Dierbach, ―Introduction to Computer Science using Python: A Computational

	Problem- Solving Focus, Wiley India Edition, 2013.
Web Resources	
1.	https://www.python.org/about/gettingstarted/
2.	https://www.programiz.com/python-programming

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	3	3
CO 3	3	3	3	2	3	2
CO 4	3	2	3	2	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	14	13	13	15	14

S-Strong-3 M-Medium-2 L-Low-1

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC4	Python Programming Lab	Core	-	-	4	-	4	4	25	75	100
Learning Objectives											
LO1	To write, test, and debug simple Python programs										
LO2	To implement Python programs with conditionals and loops.										
LO3	Use functions for structuring Python programs.										
LO4	Represent compound data using Python lists, tuples and dictionaries.										
LO5	Read and write data from/to files in Python.										
Sl. No	**Contents**										**No. of Hours**
1.	Compute the GCD of two numbers										
2.	Find the square root of a number (Newton‟s method)										

3.	Exponentiation (power of a number)	
4.	Find the maximum of a list of numbers	
5.	Linear search and Binary search.	
6.	Selection sort, Insertion sort	
7.	Merge sort	**60**
8	First n prime numbers	
9.	Multiply matrices	
10	Programs that take command line arguments (word count)	
	Total	**60**

Course Outcomes		**Programmem Outcome**
CO	Write, test, and debug simple Python programs. Read and write data from/to files in Python	
1	Implement Python programs with conditionals and loops	PO1,PO4,PO5
2	Develop Python programs step-wise by defining functions and calling them.	PO1, PO4,PO6
3	Describe the hash function and concepts of collision and its resolution methods	PO1,PO3,PO6
4	Use Python lists, tuples, dictionaries for representing compound data	PO3,PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1,PO5,PO6
Text Book		
1	Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009	

Reference Books	
1	Martin C. Brown, ―PYTHON: The Complete Reference‖, McGraw-Hill, 2001
Web Resources	
1.	https://www.sanfoundry.com/python-problems-solutions/
2.	https://www.tutorialgateway.org/python-programming-examples/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	15	13	15	13	15

S-Strong-3 M-Medium-2 L-Low-1

SECOND YEAR

SEMESTER III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC5	**Foundation of Artificial Intelligence**	Core	5	-	-	-	4	5	25	75	100
Learning Objectives											
LO1	Understand the basic concepts of intelligent agents										
LO2	Develop general-purpose problem solving agents, logical reasoning agents and agents that reason under uncertainty.										
LO3	Employ AI techniques to solve some of today‟s real world problems.										
LO4	Analyze the implications of applying AI systems to organizations and future of work.										
LO5	Explain how to develop AI systems to meet business, organizational, and technology requirements.										
UNIT	**Contents**										**No. of Hours**
I	Introduction to AI –Agents and Environments –Concept of rationality – Nature of environments –Structure of agents Problem solving agents – search algorithms –uninformed search strategies										15
II	Heuristic search strategies –heuristic functions. Local search and optimization problems –local search in continuous space –search with non-deterministic actions –search in partially observable environments –online search agents and unknown environments										15
III	Game theory –optimal decisions in games –alpha-beta search –monte-carlo tree search – stochastic games –partially observable games. Constraint satisfaction problems –constraint propagation –backtracking search for CSP –local search for CSP –structure of CSP.										15

IV	Knowledge-based agents –propositional logic –propositional theorem proving – propositional model checking –agents based on propositional logic. First-order logic –syntax and semantics –knowledge representation and engineering –inferences in first-order logic –forward chaining –backward chaining –resolution	15
V	Ontological engineering –categories and objects –events –mental objects and modal logic – reasoning systems for categories –reasoning with default information. Classical planning – algorithms for classical planning –heuristics for planning –hierarchical planning – nondeterministic domains –time, schedule, and resources –analysis.	15
	Total	**75**

Course Outcomes		**ProgrammemeOutcomea**
CO		
CO1	Understand autonomous agents that make effective decisions in fully informed, partially observable and adversarial settings	PO1
CO2	Choose appropriate algorithms for solving given AI problems	PO1,PO2
CO3	Design and implement logical reasoning agents.	PO4,PO6
CO4	Demonstrate agents that can reason under uncertainty	PO4,PO5,PO6
CO5	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	PO3,PO6

Text Book	
1	Stuart Russel and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖, Fourth Edition, Pearson Education, 2020.
2	Dan W. Patterson, ―Introduction to AI and ES‖, Pearson Education, 2007
3	Kevin Night, Elaine Rich, and Nair B., ―Artificial Intelligence‖, McGraw Hill, 2008
Reference Books	
1.	1. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006
2.	Deepak Khemani, ―Artificial Intelligence‖, Tata McGraw Hill Education, 2013

	(http://nptel.ac.in/)
3.	Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases -by Dennis Rothman, 2018
Web Resources	
1.	https://www.javatpoint.com/artificial-intelligence-ai
2.	https://www.tutorialspoint.com/artificial_intelligence/index.htm

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**2**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**2**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**15**	**14**	**12**	**14**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC6	**Internet Programming Lab**	Core	-	-	4	-	4	4	25	75	100
Learning Objectives											

LO1	To introduce the concepts of Object Oriented Programming Paradigm and the Programming constructs of JAVA	
LO2	Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.	
LO3	Read and make elementary modifications to Java programs that solve real-world problems.	
LO4	Validate input in a Java program. .	
LO5	Document a Java program using Javadoc. .	
	Details	**No. of Hours**
	List of Exercises:	
1	Write a Java Applications to extract a portion of a character string and print the extracted string.	60
2	Write a Java Program to implement the concept of multiple inheritance using Interfaces	
3	Write a Java Program to create an Exception called payout-of-bound sand throw the exception	
4 **5**	Write a Java Program to implement the concept of multi the reading with the use of any three multiplication tables and assign three different priorities to them. Write a Java Program to draw several shapes in the created windows	
6	Write a Java Program to demonstrate the Multiple Selection List-box.	
7	Write a Java Program to create a frame with three text fields for name ,age and qualification and a text Field for multiple line for address	
8	Write a Java Program to create Menu Bars and pull down menus	

9	Write a Java Program to create frames which respond to the mouse clicks.	
10	Write a Java Program to draw circle ,square ,ellipse and rectangle at the mouse click positions	
	Total	**60**

Course Outcomes		**Programmeme Outcome**
CO	On completion of this course, students will	
CO1	Apply the various basic programming constructs of JAVA like decision makingstatements.	PO1
CO2	Looping statements, overloading, inheritance, polymorphism, constructors And destructors	PO1,PO2
CO3	Illustrate the concepts of the reading and multi-threading.	PO4,PO6
CO4	Design programs using various file stream classes;file types ,and frames.	PO4,PO5,PO6
CO5	An exposure to create real time applications using JAVA	PO3,PO5

Text Book	
1	Programming with Java–A Primer-E. Balagurusamy,3rd Edition, TMH.
Reference Books	
1.	The Complete ReferenceJava2-PatrickNaughton&Hebert Schildt,3rd Edition, TMH
Web Resources	
1.	E-content from open source libraries
2.	https://www.sanfoundry.com/java-programming-examples/

Mapping with Programme Outcomes:

CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**

CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**15**	**10**

S-Strong-3 M-Medium-2 L-Low-1

SEMESTER IV

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**Ext**	**Total**
CC7	**Fundamentals of Data Science**	Core	5	-	-	-	4	5	25	75	100

Learning Objectives	
LO1	To acquire skills in data preparatory and preprocessing steps
LO2	To understand the mathematical skills in statistics
LO3	To learn the tools and packages in Python for data science
LO4	To gain understanding in classification and Regression Model
LO5	To acquire knowledge in data interpretation and visualization techniques

UNIT	**Contents**	**No. of Hours**
I	Need for data science –benefits and uses –facets of data – data science process –setting the research goal – retrieving data –cleansing, integrating and transforming data –exploratory data analysis –build the models – presenting and building applications..	15
II	Frequency distributions –Outliers –relative frequency distributions –cumulative frequency distributions – frequency distributions for nominal data –interpreting distributions –graphs – averages –mode –median –mean	15

	–averages for qualitative and ranked data.	
III	Normal distributions –z scores –normal curve problems – finding proportions –finding scores – more about z scores –correlation –scatter plots –correlation coefficient for quantitative data – computational formula for correlation coefficien	15
IV	Basics of Numpy arrays, aggregations, computations on arrays, comparisons, structured arrays, Data manipulation, data indexing and selection, operating on data, missing data, hierarchical indexing, combining datasets –aggregation and grouping, pivot tables.	15
V	Visualization with matplotlib, line plots, scatter plots, visualizing errors, density and contour plots, histograms, binnings, and density, three dimensional plotting, geographic data	15
	Total	**75**

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Apply the skills of data inspecting and cleansing.	PO1, PO2, PO6
CO2	Determine the relationship between data dependencies using statistics	PO2, PO3, PO8
CO3	Understand the can handle data using primary tools used for data science	PO1, PO3, PO5
CO4	Represent the useful information using mathematical skills.	PO2, PO6
CO5	Apply the knowledge for data describing and visualization using tools	PO1, PO3, PO6

Text Books:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, ―Introducing Data Science‖, Manning Publications, 2016.

2. Robert S. Witte and John S. Witte, ―Statistics‖, Eleventh Edition, Wiley Publications, 2017. 3. Jake VanderPlas, ―Python Data Science Handbook‖, O‟Reilly, 2016.

References :

1. Allen B. Downey, —Think Stats: Exploratory Data Analysis in Python‖, Green Tea Press, 2014.

Web Resources	
1.	https://www.w3schools.com/datascience/
2.	https://www.geeksforgeeks.org/data-science-tutorial/
3.	https://www.coursera.org/

Mapping with Programme Outcomes:

S-Strong-3 M-Medium-2 L-Low-1

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	2
CO2	3	3	3	2	2	3
CO3	2	2	2	3	3	3
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	1
Weightage of course contributed to each PSO	14	14	14	14	14	11

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC8	**Database Programming Lab**	Core	-	-	4	-	4	4	25	75	100

Learning Objectives	
LO1	To understand the database development life cycle
LO2	To learn database design using conceptual modelling, Normalization
LO3	To implement database using Data definition, Querying using SQL manipulation and SQL programming
LO4	To implement database applications using IDE/RAD tools
LO5	To learn querying Object-relational databases

EXCERCISE	**Details**

1. Database Development Life cycle: Problem definition and Requirement analysis Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) –top-down approach .Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming -Stored Procedures/Functions -Constraints and security using Triggers
6. Database design using Normalization –bottom-up approach
7. Develop database applications.
8. Create a table for Employee details with Employee Number as primary key and following fields: Name, Designation, Gender, Age, Date of Joining and Salary. Insert at least ten rows and perform various queries using any one Comparison, Logical, Set, Sorting and Grouping operators.
9. Write a PL/SQL to update the rate field by 20% more than the current rate in inventory table which has the following fields: Prono, ProName and Rate. After updating the table a new field (Alter) called for Number of item and place for values for the new field without using PL/SQL block.
10. Querying the Object-relational database using Objet Query language.

	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the database development life cycle	PO1
2	Design relational database using conceptual-to-relational mapping, Normalization	PO1, PO2

3	Apply SQL for creation, manipulation and retrieval of data	PO4, PO6
4	Develop a database applications for real-time problems	PO4, PO5, PO6

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**12**

S-Strong M-Medium L-Low

THIRD YEAR

SEMESTER V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC9	**Ethics of Artificial Intelligence**	Core	5	-	-	-	4	5	25	75	100

Learning Objectives	
LO1	To understand the need for ensuring ethics in AI
LO2	To understand ethical issues with the development of AI agents
LO3	To apply the ethical considerations in different AI applications
LO4	To evaluate the relation of ethics with nature
LO5	To overcome the risk for Human rights and other fundamental values.

UNIT	Contents	No. of Hours	Course Objectives
I	Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities	15	
II	AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral.	15	
III	Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder.	15	
IV	Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a	15	

	Binary approach, Machine learning values, Artificial Moral Agents	
V	Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics.	15
	Total	**75**

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the ethical issues in the development of AI agents	PO1
CO2	Learn the ethical considerations of AI with perspectives on ethical values	PO1, PO2
CO3	Apply the ethical policies in AI based applications and Robot development	PO4, PO6
CO4	To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights	PO4, PO5, PO6
CO5	Overcome the evil genesis in the concepts of AI	PO3, PO6

Text Books

1. Paula Boddington, ―Towards a Code of Ethics for Artificial Intelligence‖, Springer, 2017

2. Markus D. Dubber, Frank Pasquale, Sunit Das, ―The Oxford Handbook of Ethics of AI‖, Oxford University Press Edited book, 2020

3. S. Matthew Liao, ―Ethics of Artificial Intelligence‖, Oxford University Press Edited Book, 2020

References Books
1. N. Bostrom and E. Yudkowsky. ―The ethics of artificial intelligence‖. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014. 2. Wallach, W., & Allen, C, ―Moral machines: ceaching robots right from wrong‖, Oxford University Press, 2008.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	3	2	2	3
CO2	3	3	2	2	1	2
CO3	3	3	3	2	3	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	2	2
Weightage of course contribute d to each PO/PSO	15	14	14	11	10	11

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC8	**Data Science Lab**	Core	-	-	4	-	4	4	25	75	100

Learning Objectives	
LO1	Understand the Programming Language.
LO2	To prepare data for data analysis through understanding its distribution.
LO3	. Exposure on data processing using excel
LO4	To acquire knowledge in plotting using visualization tools.
LO5	To understand and implement classification and regression model.

EXCERCISE	**Details**

1. Study of Basic function in Excel
2. Working with Range Names and Tables
3. Cleaning Data with Text Functions
4. Cleaning Data containing Data Values
5. Working with VLOOKUP functions and Pivot Table.
6. Demonstration of Data Visualization in Excel.
7. Importing Data from External Source Using Excel
8. Creating a data model
9. Create a dashboard for a given requirement
10. Implement a data analytics for the real time data set

	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the basic concepts and techniques of Machine Learning.	PO1
2	Explaintheregressionmethods,classificationmethods,clusteringmethods.	PO1, PO2
3	Apply the inference and learning algorithms for the hidden Mark model.	PO4, PO6
4	Demonstrate Dimensionality reduction Techniques	PO4, PO5, PO6
5	Appreciate the underlying mathematical relationships with in and across Machine Learning algorithms and the para digms of supervise dandun-supervised learning.	PO3, PO6

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	2
CO2	3	3	3	2	2	3
CO3	2	2	1	3	3	3
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	2
Weightage of course contributed to each PSO	14	14	13	14	14	12

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC10	Database Design and Management	Core	5	-	-	-	4	5	25	75	100

Learning Objectives	
LO1	To introduce database development life cycle and conceptual modelling.
LO2	To learn SQL for data definition, manipulation and querying a database
LO3	To learn relational database design using conceptual mapping and normalization
LO4	To learn transaction concepts and serialize bility of schedules.
LO5	To learn data model and querying in object-relational and No-SQL databases

UNIT	Contents	No. of Hours
I	Database environment –Database system development lifecycle –Requirements collection – Database design - -Entity-Relationship model –Enhanced-ER model – UML class diagrams	15
II	Relational model concepts --Integrity constraints -- SQL Data manipulation –SQL Data definition –Views --SQL programming.	15
III	ER and EER-to-Relational mapping –Update anomalies –Functional dependencies-Inference rules – Minimal cover –Properties of relational decomposition –Normalization upto BCNF..	15
IV	Transaction concepts –properties –Schedules – Serializability –Concurrency Control –Two-phase locking techniques.	15
V	Mapping EER to ODB schema –Object identifier – reference types –row types –UDTs –Subtypes and super types –user-defined routines –Collection types – Object Query Language	15
	Total	**75**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand the database development life cycle and apply conceptual modeling	PO1
CO2	Apply SQL and programming in SQL to create, manipulate and query the database	PO1, PO2
CO3	Apply the conceptual-to-relational mapping and normalization to design relational database(DML)	PO4, PO6
CO4	Determine the serializability of any non-serial schedule using concurrency techniquesmultiple tables.	PO4, PO5, PO6

Text Book

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems –A Practical Approach to Design, Implementation and Management, Sixth Edition, Global Edition, Pearson Education, 2015. 2. Ramez Elmasri, Shamkant B. Navathe, Fundamental of Database Systems, 7th Edition, Pearson, 2017
Reference Books
1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, ―DATABASE MODELING AND DESIGN -Logical Design‖, Fifth Edition, Morgan Kaufmann Publishers, 2011. 2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012 3. Abraham Silberschatz, Henry F Korth, S Sudharshan, ―Database System Concepts", 6th Page 37 of 84 Edition, Tata Mc Graw Hill, 2011. 4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson. 5. S Sumathi, S Esakkirajan, ― Fundamentals of Relational Database Management Systems ", (Studies in Computational Intelligence), Springer-Verlag, 2007. 6. Raghu Ramakrishnan, ―Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010
Web Resources

1.	https://www.javatpoint.com/dbms-tutorial

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

S-Strong-3 M-Medium-2 L-Low-1

SEMESTER VI

Subject	Subject Name	Category	L	T	P	S	Credit	Marks

Code									CIA	External	Total
CC13	**Robotic Process Automation**	Core	5	-	-	-	4	5	25	75	100

Course Objective	
LO1	To introduce the fundamental concept sand techniques of natural language processing(NLP)
LO2	Model the workflow of different scrapping methodologies
LO3	Understand how the Citrix and the Image Recognition can be helpful
LO4	Understand Image, Text and Data Tables Automation..
LO5	To learn the concept of Robatic Process

UNIT	**Contents**	**No. of Hours**
I	Robotic Process Automation (RPA):Fundamentals of RPA – Programming basics from RPA perspective – Applying RPA – RPA development methodology – Architecture of RPA – RPA and emerging ecosystem	15
II	Basics of RPA - RPA Benefits - Processes that can be automated – Types of Robots. Automation and RPA Concepts: Business models for implementing RPA – Centre of Excellence - Types and their applications – Building an RPA team - Approach for implementing RPA initiatives.	15
III	Automation stages and the role of a Business Manager - Guidelines for tracking the implementation success – Metrics /Parameters to be considered for gauging success- Choosing the right licensing option.	15
IV	Introduction - Automation debugging – Automation library – Activities Packages – Basic automation tasks - Text and image automation.Setting up the UiPath environment -– Introduction to UiPath - The User Interface - Keyboard Shortcuts.	15
V	Tables in RPA - Data Manipulation in excel - Extracting Data from PDF – Using anchors in PDF.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	

CO1	Understandthefundamentalconceptsandtechniquesof naturallanguageprocessing (NLP)	PO1
CO2	Understanding of the models and algorithms in the field of NLP	PO1, PO2
CO3	Demonstrate the computational proper ties of natural languages and the commonly used algorithms for processing linguistic in formation.	PO4, PO6
CO4	Understanding semantic sand pragmatics of languages for processing	PO4, PO5, PO6
CO5	To understand Robatics Process Automation	PO3, PO4

Text Book

1. Robotic Process Automation using UiPath StudioX: A Citizen Developer‟s Guide to HyperautomationPaperback June 2021by Adeel Javed, Anum Sundrani, Nadia Malik, Sidney Madison Prescott.
2. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath Paperback March 2018by Alok Mani Tripathi

Reference Books

Reference URL (s)

1. https://www.uipath.com/landing/academic-studio-download
2. https://www.uipath.com/rpa/robotic-process-automation Page 64 of 84
3. https://www.uipath.com/rpa/academy

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**2**	**3**	**2**	**3**
CO2	**3**	**2**	**2**	**2**	**2**	**2**

CO3	**3**	**2**	**3**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**2**	**2**
CO5	**3**	**2**	**2**	**2**	**2**	**3**
Weightage of course contributed to each PSO	**15**	**11**	**11**	**12**	**10**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**
CC14	**Natural Language Processing**	Core	6	-	-	-	4
Course Objective							
C1	To introduce the fundamental concept sand techniques of natural language processing(NLP).						
C2	Develop speech-based applications that use speech analysis (phonetics, speech recognition, and synthe						
C3	Analyze the syntax, semantics, and pragmatics of a statement written in a natural language.						
C4	Develop a conversational agent that uses natural language understanding and generation.						
C5	Evaluate the performance of NLP tools and systems. .						
UNIT	**Contents**						
I	Introduction :application of NLP technique sand key issues-MT grammercheckers-dictation– document generation- NL interfaces- Natural language processing key issues- the different						

	analysislevelusedforNLP:morpho-lexical-syntactic-semantic-pragmatic-markup(TEI,UNICODE)-finite state automata- Recursive and augmented transition networks-open problems
II	Lexicallevel:errortolerantlexicalprocessing(spellingerrorcorrection)-ransducersforthedesignofmorphologicanalyzersfeatures-towardssyntax: part-of- speech tagging (BRILL,HMM)-efficient representations for linguisticre sources (lexica,grammars,….) trie sand Finite state automata
III	Syntacticlevel:grammars(eg.formal/Chomskyhierarchy,DCSGs,systematiccase,unification,stochastic) -parsing(top-down,bottomup,char(earlyalgorithm),CYKalgorithm)-automatedestimationofprobabilisticmodelparameters(inside-outsidealgorithm)-dataorientedparsinggrammarformalismsandtreebanks-efficientpatsingforcontext-freegrammars(CFGs)-statistcial Parsing and probabilistic CFGs(PCFGs)-lexicilized PCFGse..
IV	Semanticlevel:logicalforms-ambiguityresolution-semanticnetworkandparsers-procedural semantics-montaguesemantics-vectorspaceapproaches-distributionalsemanticslexicalsemanticsandword sense disambiguation-compositional semantic semantic rolela belingandsematic parsing
V	Pragmaticlevel:knowledgerepresentation-reasoning-plan/goalrecognition–speechacts/intentions – belief models- discourse- reference. Natural language generation: content determination – sent en ceplanning- surfa cerealization, subjectivity and sentiment analysis..
	Total

Course Outcomes		**Program**
CO	On completion of this course, students will	
1	Understandthefundamentalconceptsandtechniquesofnaturallanguageprocessing (NLP)	PO1, PO2, PO6
2	Understanding of the models and algorithm sin the field of NLP	PO2, PO3, PO5
3	Demonstrate the computational properties of natural languages and the commonly used Algorithms for proc assign linguistic information	PO1, PO3, PO6
4	Understanding semantic sand pragmatics of languages for processing	PO2, PO6
5	To develop NLP Application	PO1, PO3, PO6
Text Book		

1.DanielJandJamesH.Martin,‖speechandlanguageprocessing‖anintroductiontonatural languageprocessing,computationallinguistcs&speechrecognition‖prenticehall,2009
Reference Books
LanHWrittenandElbef,MarkA.Hall,‖datamining:practicalmachinelearningtoolsand techiniques‖,Morgan Kaufmann,2013

	Web Resources
1.	https://www.tutorialspoint.com/natural_language_processing/index.htm
2.	https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	2	3
CO2	3	2	2	3	3	3
CO3	3	3	3	2	3	3
CO4	2	2	1	3	3	2
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	13	12	14	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject	Subject Name	C a t	L	T	P	S	C	I	Marks

Code									CIA	External	Total
CC15	**Programming in UI Path Automation Lab**	Core	-	-	5	-	4	5	25	75	100

Course Objective	
LO1	To get a knowledge in dissecting the myths from the facts and realize the true benefits of RPA
LO2	To create Acquire knowledge of fundamental UI automation concepts
LO3	To Gain ability to create and debug workflows using UiPath
LO4	To implement Master installation of UiPath Studio on Windows
LO5	To Gain ability to implement error exception handling

Sl. No	**Programs**	**No. of Hours**
	1. Robotic Process Automation – Introduction, Working 2. UiPath – Basics, Installation and Understanding User Interface Components 3. Keyboard Shortcuts & Customization. 4. Visual workflow automation straightforward and intuitive 5. UiPath is providing automated workflow design, Which can be used without programming knowledge 6 Recording are important functionality of UiPath studio, enables us to capture user‟s action on the screen and translate them into sequences. 7. Excel Automation 8. Email Automation	**60**
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understand business functionalities in Robotics Process Automation	PO1, PO2, PO4
CO2	Implement RPA functions across the Organizations to boost revenues	PO3, PO5
CO3	Demonstrate the basics of robotic process automation using UI Path.	PO1, PO4, PO5
CO4	Manage RPA solutions to ensure lasting results	PO2, PO4, PO6
CO5	To develop a software to solve real-world problems using UI PATH	PO1,PO3, PO5, PO6
2	Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill,2015.	

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

S-Strong-3 M-Medium-2 L-Low-1

SUGGESTED CORE COMPONENTS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	PROGRAMMING IN C	Core	5	-	-	-	4	5	25	75	100
Learning Objective											
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations.										
LO2	To understand the concept using if statements and loops										
LO3	This unit covers the concept of Arrays and Functions										
LO4	This unit covers the concept of Structurs and unions and Preprocessors										
LO5	To understand the concept of implementing pointers.										
UNIT	**Contents**								**No. of Hours**		
I	**Overview of C**: Importance of C, sample C program, C program structure, executing C program. Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables--- Assignment statement, declaring a variable as constant, as volatile. **Operators and Expression**: Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions **Managing Input and Output Operators**: Reading and writing a character, formatted input, formatted output.								15		
II	**Decision Making and Branching**: Decision making with If, simple IF, IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement. **Decision Making and Looping**: While, Do-While, For, Jumps in loops.								15		

III	**Arrays**: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays. **Functions**: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions.	15
IV	**Structures and Unions**: Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions. **Preprocessors**: Macro substitution, file inclusion.	15
V	**Pointers:** definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and structures.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Remember the program structure of C with its syntax and semantics	PO1,PO3,PO5
CO2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6
CO3	Apply the programming principles learnt in real-time problems	PO3,PO4,PO5
CO4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
CO5	Code, debug and test the programs with appropriate test cases	PO5,PO6

Text Book	
1	E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.
Reference Books	
1.	Byron Gottfried, Schaum‘s Outline Programming with C, Fourth Edition, Tata

	McGraw-Hill, 2018.
2.	Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998
3.	YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021
Web Resources	
1.	https://codeforwin.org/
2.	https://www.geeksforgeeks.org/c-programming-language/
3.	http://en.cppreference.com/w/c
4.	http://learn-c.org/
5.	https://www.cprogramming.com/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	2	3	3
CO 3	2	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	2
Weight age of course contributed to each PSO	14	15	14	14	15	13

S-Strong-3 M-Medium-2 L-Low-1

Subject	Subject Name	Category	L	T	P	S	Credit	Marks

Code									CIA	External	Total
	PROGRAMMING IN C LAB	Core	-	-	4	-	4	4	25	75	100

Course Objective	
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations.
LO2	To understand the concept using if statements and loops
LO3	This unit covers the concept of Arrays and Functions
LO4	This unit covers the concept of Structurs and unions and Preprocessors
LO5	To understand the concept of implementing pointers and files

UNIT	**List of Excercises**	**No. of Hours**	**Course Objectives**
I	**Unit I : Variables, Data types, Constants and Operators** 1.Evaluation of expression ex: ((x+y) ^2 * (x+z))/w 2.Temperature conversion problem (Fahrenheit to Celsius) 3. Program to convert days to months and days (Ex: 364 days = 12 months and 4 days) 4. Solution of quadratic equation 5. Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales)	12	
II	**Unit II: Decision making Statements** 6. Maximum of three numbers 7. Calculate Square root of five numbers (using gototatement) 8. Pay-Bill Calculation for different levels of employee (Switch statement) 9. Fibonacci series 10. Floyds Triangle 11. Pascal‘s Triangle	12	

III	**Unit III: Arrays, Functions and Strings** 12. Prime numbers in an array 13. Sorting data (Ascending and Descending) 14. Matrix Addition and Subtraction 15. Matrix Multiplication 16. Function with no arguments and no return values 17. Function that convert lower case letters to upper case 18. Factorial using recursion. 19. Perform String Operations using Switch Case.	12
IV	**Unit IV : Structures and Macros** 20. Structure that describes a Hotel (name, address, grade, avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.) 21. Using Pointers in Structures. 22. Cricket team details using Union. 23. Write a macro that calculates the max and min of two numbers 24. Nested macro to calculate Cube of a number.	12
V	**Unit V : Pointers and Files** 25. Evaluation of Pointer expressions 26. Function to exchange two pointer values 27. Creation, insertion and deletion in a linked list 28. Program to read a file and print the data. 29. Program to receive a file name and a line of text as command line arguments and write the text to the file 30. Program to copy the content of one file to another file.	12
	Total	**60**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Remember the program structure of C with its syntax and semantics	PO1,PO3,PO5
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6
3	Apply the programming principles learnt in real-time problems	PO3,PO4
4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
5	Code, debug and test the programs with appropriate test cases	PO4,PO6
Text Book		
1	E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.	
Reference Books		
1.	Byron Gottfried, Schaum‘s Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.	
2.	Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998	
3.	YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021	
Web Resources		
1.	https://codeforwin.org/	
2.	https://www.geeksforgeeks.org/c-programming-language/	
3.	http://en.cppreference.com/w/c	
4.	http://learn-c.org/	
5.	https://www.cprogramming.com/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weight age of course contributed to each PSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	OBJECT ORIENTED PROGRAMMING USING C++	Core	5	-	-	-	4	5	25	75	100

Learning Objective	
LO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
LO2	Understand dynamic memory management techniques using pointers, constructors, destructors, etc
LO3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
LO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
LO5	Demonstrate the use of various OOPs concepts with the help of programs

UNIT	**Contents**	**No. of Hours**
I	Introduction to C++ - key concepts of Object-Oriented Programming – Advantages – ObjectOriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Makingand Statements : If ..else, jump, goto, break, continue, Switch case statements - Loops in	15

	C++ :for, while, do - functions in C++ - inline functions – Function Overloading.	
II	Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variablesand functions – array of objects –friend functions – Overloading member functions – Bit fieldsand classes – Constructor and destructor with static members.	15
III	Operator Overloading: Overloading unary, binary operators – Overloading Friend functions –type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal,Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.	15
IV	Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes andBase classes – Arrays – Characteristics – array of classes – Memory models – new and deleteoperators – dynamic object – Binding, Polymorphism and Virtual Functions.	15
V	Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCIIFiles – Random Access Operation – Templates – Exception Handling - String – Declaring andInitializing string objects – String Attributes – Miscellaneous functions.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	Upon completion of the course the students would be able to:	
1	Remember the program structure of C with its syntax and semantics	PO1,PO6
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2
3	Apply the programming principles learnt in real-time problems	PO4 ,PO5
4	Analyze the various methods of solving a problem and choose the best method	PO6
5	Code, debug and test the programs with appropriate test cases	PO3,PO6

Text Book	
1	E. Balagurusamy, ―Object-Oriented Programming with C++‖, TMH 2013, 7th Edition.

Reference Books	
1.	Ashok N Kamthane, ―Object-Oriented Programming with ANSI and Turbo C++‖, Pearson Education 2003.

2.	Maria Litvin& Gray Litvin, ―C++ for you‖, Vikas publication 2002.
Web Resources	
1.	https://alison.com/course/introduction-to-c-plus-plus-programming

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	2	3	3
CO 3	3	2	2	2	3	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	2	3	3
Weight age of course contributed to each PSO	15	13	14	12	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	OBJECT ORIENTED PROGRAMMING USING C++LAB	Core	-	-	4	-	4	4	25	75	100
Course Objective											
C1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects										
C2	Understand dynamic memory management techniques using pointers, constructors,										

	destructors, etc	
C3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism	
C4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming	
C5	Demonstrate the use of various OOPs concepts with the help of programs	
S.No	**List of Excercises**	**No. of Hours**
1	Write a C++ program to demonstrate function overloading, Default Arguments and Inlinefunction.	60
2	Write a C++ program to demonstrate Class and Objects	
3	Write a C++ program to demonstrate the concept of Passing Objects to Functions	
4	Write a C++ program to demonstrate the Friend Functions.	
5	Write a C++ program to demonstrate the concept of Passing Objects to Functions	
6	Write a C++ program to demonstrate Constructor and Destructor	
7	Write a C++ program to demonstrate Unary Operator Overloading	
8	Write a C++ program to demonstrate Binary Operator Overloading	
9	Write a C++ program to demonstrate: • Single Inheritance • Multilevel Inheritance • Multiple Inheritance • Hierarchical Inheritance • Hybrid Inheritance	
10	Write a C++ program to demonstrate Virtual Functions.	
11	Write a C++ program to manipulate a Text File.	

12	Write a C++ program to perform Sequential I/O Operations on a file.	
13	Write a C++ program to find the Biggest Number using Command Line Arguments	
14	Write a C++ program to demonstrate Class Template	
15	Write a C++ program to demonstrate Function Template.	
16	Write a C++ program to demonstrate Exception Handling.	

Course Outcomes		**Programme Outcome**
CO	Upon completion of the course the students would be able to:	
1	Remember the program structure of C with its syntax and semantics	PO4,PO5
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO6
3	Apply the programming principles learnt in real-time problems	PO4 ,PO5
4	Analyze the various methods of solving a problem and choose the best method	PO6
5	Code, debug and test the programs with appropriate test cases	PO4,PO5

Text Book	
1	E. Balagurusamy, ―Object-Oriented Programming with C++‖, TMH 2013, 7th Edition.

Reference Books	
1.	Ashok N Kamthane, ―Object-Oriented Programming with ANSI and Turbo C++‖, Pearson Education 2003.
2.	Maria Litvin& Gray Litvin, ―C++ for you‖, Vikas publication 2002.

Web Resources	
1.	https://alison.com/course/introduction-to-c-plus-plus-programming

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	2	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	2	2	3	3	3
CO 5	3	2	3	3	3	2
Weightage of course contributed to each PSO	15	12	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	MOBILE APPLICATION DEVELOPMENT	**Core**	**5**	**-**	**-**	**-**	**4**	**5**	**25**	**75**	**100**
		Core									

LO1 **LO2** **LO3**			To provide the students with the basics of Android Programming To gain knowledge on Software Development tools for Mobile Applications Development of software on mobile platform for Real Time use	
Unit			**Contents**	**No. of Hours**
I			IntroductiontoAndroidOperatingSystem– ConfigurationofAndroidEnvironment- CreatetheFirstAndroid Application.Layout: Vertical, Vertical Scroll, horizontal, horizontal Scroll, Table Layout arrangement. **Designing User Interface:** Label Text - TextView – Password Text Box - Button – ImageButton– CheckBox– Image - RadioButton – Slider – Autocomplete text View.	**15**
II			User Interface: Spinner–Switch – Side Bar-ListView - List Picker -Image Picker - Notifier-Time andDatePicker - Web Viewer	**15**
III			Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player - Canvas	**15**
IV			Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Email Picker – Phone Number Picker – Phone Call - Social: Texting	**15**
V			Storage: Cloud DB – Tiny DB – Experimental – Fire DB	**15**
			TOTAL	**75**
CO			**Course Outcomes**	
CO1			Charttherequirementsneededfordevelopingandroidapplication	
CO2			Identify the results by executing the application in emulator or in android device	
CO3			Applyproperinterfacesetup,styles&themes,storingandmanagement	
CO4			Analyzetheproblemandaddnecessaryuserinterfacecomponents,graphicsand multimediacomponentsintotheapplication.	
CO5			Evaluate theresultsbyimplementing the conceptbehindtheproblemwithpropercode.	
			Textbooks	
1			Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books	

	Limited.
Reference Books	
1	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.
2	Deital, Android for Programmers-An App-Driven Approach,Second Edition.
	NOTE: Latest Edition of Textbooks May be Used
Web Resources	
	http://ai2.appinventor.mit.edu/reference/
	http://appinventor.mit.edu/explore/paint-pot-extended-camera

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**3**	**3**	**3**	**3**
Weightageofcoursecontributedtoeach PSO	**14**	**13**	**14**	**14**	**14**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	MOBILE APPLICATION DEVELOPMENT LAB	**Core**	-	-	4	-	4	25	75	100

Learning Objectives:

LO1. To explain user defined functions and the concepts of class.
LO2. To demonstrate the creation cookies and sessions
LO3. To facilitate the creation of Database and validate the user inputs

Lab Exercises	Required Hours
1. Develop an application for Simple Counter. 2. Develop an application to display your personal details using GUI Components. 3. Develop a Simple Calculator that uses radio buttons and text view. 4. Develop an application that uses Intent and Activity. 5. Develop an application that uses Dialog Boxes. 6. Develop an application to display a Splash Screen. 7. Develop an application that uses Layout Managers. 8. Develop an application that uses different types of Menus. 9. Develop an application that uses to send messages from one mobile to another mobile. 10. Develop an application that uses to send E-mail. Develop an application that plays Audio and Video. 11. Develop an application that uses Local File Storage. 12. Develop an application for Simple Animation. 13. Develop an application for Login Page using Sqlite. 14. Develop an application for Student Marksheet processing using Sqlite.	**60**

Course Outcomes	
CO	On completion of this course, students will able to
CO1	Understand the concepts of counter and dialogs.
CO2	Concepts of Layout Managers. Perform sending email on audio and video To enable the applications of audio and video.
CO3	To apply Local File Storage and Development of files.
CO4	To determine the concepts of Simple Animation To apply searching pages.
CO5	Usage of Student mark sheet- preparation in MAD. Concepts of processing Sqlite are implemented.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	2	3	3

CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	15	15	13	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Data analytics using R	Core	5	-	-	-	4	5	25	75	100

Course Objective	
C1	To understand the problem solving approaches
C2	To learn the basic programming constructs in R Programming
C3	To learn the basic programming constructs in R Programming
C4	To use R Programming data structures - lists, tuples, and dictionaries.
C5	To do input/output with files in R Programming.

UNIT	**Contents**	**No. of Hours**
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model	15
II	CONTROL STRUCTURES AND VECTORS -Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings,	15

	Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations	
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	15
IV	FACTORS AND TABLES - Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING .	15
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	15

	Total	75
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO3
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO2, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO5, PO6
Text Book		
1	Roger D. Peng,‖ R Programming for Data Science ―, 2012	
2	Norman Matloff,‖The Art of R Programming- A Tour of Statistical Software Design‖, 2011	
Reference Books		
1.	1. Garrett Grolemund, Hadley Wickham,‖Hands-On Programming with R: Write Your Own Functions and Simulations‖ , 1st Edition, 2014	
2.	Venables ,W.N.,andRipley,‖S programming―, Springer, 2000.	
Web Resources		
1.	https://www.simplilearn.com	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**3**	**3**	**3**	**3**

Weightageofcoursecontributedtoeach PSO	**14**	**13**	**14**	**14**	**14**	**13**					

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Data analytics using R Lab	Core	-	-	4	-	4	4	25	75	100

Course Objective		
C1	To understand the problem solving approaches	
C2	To learn the basic programming constructs in R Programming	
C3	To practice various computing strategies for R Programming -based solutions to real world problems	
C4	To use R Programming data structures - lists, tuples, and dictionaries.	
C5	To do input/output with files in R Programming.	
Sl. No	**Contents**	
1.	Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user‘s choice.	
2.	Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.	
3.	Write a program to find list of even numbers from 1 to n using R-Loops.	
4.	Create a function to print squares of numbers in sequence.	**60**
5.	Write a program to join columns and rows in a data frame using cbind() and rbind() in R.	

6.	Implement different String Manipulation functions in R.	
7.	Implement different data structures in R (Vectors, Lists, Data Frames)	
8	Write a program to read a csv file and analyze the data in the file in R.	
9	Create pie chart and bar chart using R.	
10	10. Create a data set and do statistical analysis on the data using R.	
11	Program to find factorial of the given number using recursive function	
12	Write a R program to count the number of even and odd numbers from array of N numbers.	
	Total	**60**

Course Outcomes		**Programe Outcome**
CO	On completion of this course, students will	
1	Acquire programming skills in core R Programming	PO1,PO4,PO5
2	Acquire Object-oriented programming skills in R Programming.	PO1, PO4,PO6
3	Develop the skill of designing graphical-user interfaces (GUI) in R Programming	PO1,PO3,PO6
4	Acquire R Programming skills to move into specific branches	PO3,PO4
5		PO1,PO5,PO6

Text Book

1	Roger D. Peng,‖ R Programming for Data Science ―, 2012
2	Norman Matloff,‖The Art of R Programming- A Tour of Statistical Software Design‖, 2011

Reference Books

1	Garrett Grolemund, Hadley Wickham,‖Hands-On Programming with R: Write Your Own Functions and Simulations‖ , 1st Edition, 2014
2.	Venables ,W.N.,andRipley,‖S programming―, Springer, 2000.

Web Resources

1.	https://www.simplilearn.com

Subject Code	Subject Name	Category	L	T	P	S	Credits	Instruction hour	Marks		
									CIA	External	Total
	MACHINE LEARNING	**Core**	5	-	-	-	4	5	25	75	100

Learning Objectives	
LO1	To Learn about Machine Intelligence and Machine Learning applications
LO2	To implement and apply machine learning algorithms to real-world applications
LO3	To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems
LO4	To create instant based learning
LO5	To apply advanced learning

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction Machine Learning** - Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines	**15**
II	**Neural networks and genetic algorithms** Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.	**15**
III	**Bayesian and computational learning** Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	**15**
IV	**Instant based learning** K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.	**15**

V	**Advanced learning** Recommendation systems – opinion mining, sentiment analysis. Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Appreciate the importance of visualization in the data analytics solution	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply structured thinking to unstructured problems	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand a very broad collection of machine learning algorithms and problems	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theor	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop an appreciation for what is involved in learning from data.	PO1, PO2, PO3, PO4, PO5, PO6

Reference Books

1		Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2		Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press
1.		EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2		Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Instruction Hours	Credits	Marks		
									CIA	External	Total
	MACHINE LEARNING LAB	**Core**	-	-	4	-	4	4	25	75	100

Learning Objectives:

To apply the concepts of Machine Learning to solve real-world problems and to implement basic algorithms in clustering & classification applied to text & numeric data

	LAB EXERCISES	Required Hour
	1. Solving Regression & Classification using Decision Trees 2. Root Node Attribute Selection for Decision Trees using Information Gain 3. Bayesian Inference in Gene Expression Analysis 4. Pattern Recognition Application using Bayesian Inference 5. Bagging in Classification 6. Bagging, Boosting applications using Regression Trees 7. Data & Text Classification using Neural Networks 8. Using Weka tool for SVM classification for chosen domain application 9. Data & Text Clustering using K-means algorithm 10. Data & Text Clustering using Gaussian Mixture Models	**60**

Course Outcomes	
CO	On completion of this course, students will
CO1	Effectively use the various machine learning tools
CO2	Understand and implement the procedures for machine learning algorithms
CO3	Design Python programs for various machine learning algorithms
CO4	Apply appropriate datasets to the Machine Learning algorithms
CO5	Analyze the graphical outcomes of learning algorithms with specific datasets

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	3	3	3
CO 4	2	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	14	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Data mining and warehousing	Core	5	-	-	-	4	5	25	75	100

Learning Objectives			
LO1	To provide the knowledge on Data Mining and Warehousing concepts and techniques		
LO2	To study the basic concepts of Data Mining, Architecture and Comparison.		
LO3	To study a set of Mining Association Rules, Data Warehouses.		
LO4	To study about Classification and Prediction, Classifier Accuracy		
LO5	To study the basic concepts of cluster analysis, Cluster Methods		
UNIT	**Contents**	**No. of Hours**	**Course Objectives**
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration and Transformation – Data Reduction	15	
II	Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures.	15	
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension	15	

	Association Rules from Relational Database and Data Warehouses.	
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy	15
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Petitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method	15
	Total	**75**
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	To understand the basic concepts and the functionality of the various data mining and data warehousing component	PO1, PO3, PO6, PO8
CO2	To know the concepts of Data mining system architectures	PO1,PO2,PO3,PO6
CO3	To analyze the principles of association rules	PO3, PO5
CO4	To get analytical idea on Classification and prediction methods	PO1, PO2, PO3, PO5
CO5	To Gain knowledge on Cluster analysis and its methods.	PO2, PO4, PO6
Text Books (Latest Editions)		
1.	Han and M. Kamber, ―Data Mining Concepts and Techniques‖, 2001, Harcourt India Pvt. Ltd, New Delhi.	
References Books (Latest editions)		
1.	K.P. Soman, ShyamDiwakar, V. Ajay ―Insight into Data Mining Theory and Practice ―,Prentice Hall of India Pvt. Ltd, New Delhi	
2.	Parteek Bhatia, ‗Data Mining and Data Warehousing: Principles and Practical Techniques', Cambridge University Press, 2019	

Web Resources	
1.	https://www.topcoder.com/thrive/articles/data-warehousing-and-data-mining#:~:text=Data%20warehousing%20is%20a%20method,compiled%20in%20the%20data%20warehouse.
2.	https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing
3.	https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	3
Weightageofcoursecontributedtoeach PSO	14	13	14	14	14	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	SOFTWARE METRICS	Core	-	5	-	-	4	5	25	75	100

Learning Objectives	
LO1	Gain a solid understanding of what software metrics are and their significance
LO2	Learn how to identify and select appropriate software metrics based on project goals
LO3	Acquire knowledge and skills in collecting and measuring software metrics
LO4	Learn how to analyze and interpret software metrics data to extract valuable insights
LO5	Gain the ability to evaluate software quality using appropriate metrics

Unit	Contents	No. of Hours

I	**Fundamentals of Measurement: Need for** Measurement: Measurement in Software Engineering, Scope of Software Metrics, **The Basics of measurement**: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement	**15**
II	**A Goal-Based Framework For Software Measurement:** Classifying software measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing SoftwareMeasurementValidation **Empirical investigation**: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments, Relevant and Meaningful Studies	**15**
III	**Software Metrics Data Collection:** Defining good data, Data collection for incident reports, How to collect data, Reliability of data collection Procedures **Analyzing software measurement data:** Statistical distributions and hypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques	**15**
IV	**Measuring internal product attributes: Size** Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures **Measuring internal product attributes: Structure:** Aspects of Structural Measures, Control flow structure of program units, Design-levelAttributes, Object-oriented Structural attributes and measures	**15**
V	**Measuring External Product Attributes:** Modelling software quality, Measuring aspects of quality, Usability Measures, Maintainability measures,SecurityMeasures **Software Reliability: Measurement and Prediction:** Basics of reliability theory, The software reliability problem, Parametric reliability growth models, Predictive accuracy	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Understand various fundamentals of measurement and software metrics
CO2	Identify frame work and analysis techniques for software measurement

CO3	Apply internal and external attributes of software product for effort estimation
CO4	Use appropriate analytical techniques to interpret software metrics data and derive meaningful insights
CO5	Recommend reliability models for predicting software quality
Textbooks	
1	Software Metrics A Rigorous and Practical Approach, Norman Fenton, James Bieman , Third Edition, 2014
Reference Books	
1	Software metrics, Norman E, Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 1997
2	Metric and models in software quality engineering, Stephen H.Kan, Second edition, 2002, Addison Wesley Professional
3	Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	https://lansa.com/blog/general/what-are-software-metrics-how-can-i-measure-these-metrics/
2.	https://stackify.com/track-software-metrics/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**3**	**3**	**3**	**3**
Weightageofcoursecontributedtoeach PSO	**14**	**13**	**14**	**14**	**14**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credited	Hours	Marks

									CIA	External	Total
	Network Security	Core	5	-	-	-	4	5	25	75	100
Course Objectives											
CO1	To familiarize on the model of network security, Encryption techniques										
CO2	To understand the concept of Number Theory , theorems										
CO3	To understand the design concept of cryptography and authentication										
CO4	To develop experiments on algorithm used for security										
CO5	To understand about virus and threats, firewalls, and implementation of Cryptography										

UNIT	**Contents**	**No. of Hours**
I	Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher PrinciplesDES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality.	15
II	Number Theory – Prime number – Modular arithmetic – Euclid‘s algorithm - Fermet‘s and Euler‘s theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography	15
III	Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.	15
IV	Authentication applications – Kerberos – X.509 Authentication services - E- mail security – IP security	15

	- Web security	
V	Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security	15
	Total	**75**
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Analyze and design classical encryption techniques and block ciphers.	PO1, PO3, PO6
CO2	Understand and analyze public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc	PO1,PO2,PO3,PO5
CO3	Understand key management and distribution schemes and design User Authentication	PO4, PO5
CO4	Analyze and design hash and MAC algorithms, and digital signatures.	PO1, PO2, PO3, PO6
CO5	Know about Intruders and Intruder Detection mechanisms, Types of Malicious software,	P02, PO6
Reference Text :		
1.	William Stallings, ―Cryptography & Network Security‖, Pearson Education, Fourth Edition 2010.	
References		
1.	CharlieKaufman,RadiaPerlman,MikeSpeciner,―NetworkSecurity,Privatecommunicationinpublicworld‖,PHISecondEdition,2002	
2.	Bruce Schneier, Neils Ferguson, ―Practical Cryptography‖, Wiley Dreamtech India Pvt Ltd, First Edition, 2003.	
3.	DouglasRSimson―Cryptography–Theoryandpractice‖,CRCPress,FirstEdition,1995	
Web Resources		
1.	https://www.javatpoint.com/computer-network-security	
2.	https://www.tutorialspoint.com/information_security_cyber_law/network_securi	

	ty.htm
3.	https://www.geeksforgeeks.org/network-security/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	2	2	2	3	3
Weightageofcoursecontributedtoeach PSO	14	12	13	13	14	13

S-Strong-3 M-Medium-2 L-Low-1

Annexure - I

Elective Course (EC1- EC8)

Discipline Specific

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ANALYTICSFOR SERVICE INDUSTRY	**Elect**	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	Recognize challenges in dealing with data sets in service industry.
LO2	Identify and apply appropriate algorithms for analyzing the healthcare, Human resource, hospitality and tourism data.
LO3	Make choices for a model for new machine learning tasks.
LO4	To identify employees with high attrition risk.
LO5	To Prioritizing various talent management initiatives for your organization.

UNIT	**Contents**	**No. Of. Hours**
I	**Healthcare Analytics :** Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges-Phenotyping Algorithms. Biomedical Image Analysis and Signal Analysis- Genomic Data Analysis for Personalized Medicine. Review of Clinical Prediction Models.	**12**
II	**Healthcare Analytics Applications :** Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer- Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.	**12**
III	**HR Analytics:** Evolution of HR Analytics, HR information systems and	**12**

	data sources, HR Metric and HR Analytics, Evolution of HR Analytics; HR Metrics and HR Analytics; Intuition versus analytical thinking; HRMS/HRIS and data sources; Analytics frameworks like LAMP, HCM:21(r) Model.	
IV	**PerformanceAnalysis:** Predicting employee performance,Training requirements, evaluating training and development, Optimizing selection and promotion decisions.	**12**
V	**Tourism and Hospitality Analytics:** Guest Analytics – Loyalty Analytics – Customer Satisfaction – Dynamic Pricing – optimized disruption management – Fraud detection in payments.	**12**
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand and critically apply the concepts and methods of business analytics	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Identify, model and solve decision problems in different settings.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Create viable solutions to decision making problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Chandan K. Reddy and Charu C Aggarwal, ―Healthcare data analytics‖, Taylor & Francis, 2015.
2	Edwards Martin R, Edwards Kirsten (2016),―Predictive HR Analytics: Mastering the HR Metric‖, Kogan Page Publishers, ISBN-0749473924
3	Fitz-enzJac (2010), ―The new HR analytics: predicting the economic value of your company‘s human capital investments‖, AMACOM, ISBN-13: 978-0-8144-1643-3
4	RajendraSahu, Manoj Dash and Anil Kumar. Applying Predictive Analytics Within the Service Sector.

Reference Books	
1.	Hui Yang and Eva K. Lee, ―Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016
2.	Fitz-enzJac, Mattox II John (2014), ―Predictive Analytics for Human Resources‖, Wiley, ISBN- 1118940709.
Web Resources	
1.	https://www.ukessays.com/essays/marketing/contemporary-issues-in-marketing-marketing-essay.php
2.	https://yourbusiness.azcentral.com/examples-contemporary-issues-marketing-field-26524.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
WeightageofcoursecontributedtoeachPSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	CRYPTOGRAPHY	**Elect**	4	-	-	-	3	25	75	100
Learning Objectives										
LO1	To understand the fundamentals of Cryptography									
LO2	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.									
LO3	To understand the various key distribution and management schemes.									

LO4	To understand how to deploy encryption techniques to secure data in transit across data networks	
LO5	To design security applications in the field of Information technology	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction:** The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.	**12**
II	**Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	**12**
III	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm.	**12**
IV	**Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: SecureSocketLayerand Transport Layer Security – Secure Electronic Transaction.	**12**
V	Intruders – Malicious software – Firewalls.	**12**
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the different cryptographic operations of public key cryptography	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply the various Authentication schemes to simulate different applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand various Security practices and System security standards	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	**William Stallings, —**Cryptography and Network Security Principles andPractices‖.
Reference Books	
1.	**Behrouz A. Foruzan, —**Cryptography and Network Security‖, Tata McGraw-Hill, 2007.

2	**AtulKahate**, —*Cryptography and Network Security*‖, Second Edition, 2003,TMH.
3	**M.V. Arun Kumar**, —*Network Security*‖, 2011, First Edition,USP.
	Web Resources
1	https://www.tutorialspoint.com/cryptography/
2	https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
WeightageofcoursecontributedtoeachPSO	14	13	15	12	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Big Data Analytics	Elective	4	-	-	-	3	4	25	75	100
Course Objective											
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs										
C2	To identify and understand the basics of cluster and decision tree										

C3	To study about the Association Rules,Recommendation System		
C4	To learn about the concept of stream		
C5	Understand the concepts of NoSQL Databases		
UNIT	**Contents**	**No. of Hours**	**Course Objective**
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — Map Reduce and YARN — Map Reduce Programming Model	12	
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes Theorem — Naïve Bayes Classifier.	12	
III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.	12	

IV	Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	12
V	NoSQL Databases : Schema-less Models : Increasing Flexibility for Data Manipulation-Key Value Stores-Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO5
4	Perform analytics on data streams.	PO3, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO4

Text Book

1. AnandRajaraman and Jeffrey David Ullman, ―Mining of Massive Datasets‖, Cambridge University Press, 2012.

Reference Books

1. David Loshin, ―Big Data Analytics: From Strategic Planning to Enterprise

	Integration with Tools, Techniques, NoSQL, and Graph‖, Morgan Kaufmann/El sevier Publishers, 2013
2.	EMC Education Services, ―Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data‖, Wiley publishers, 2015.
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Internet of Things and its applications	Elective	4	-	-	-	3	4	25	75	100
Course Objective											
C1	Use of Devices, Gateways and Data Management in IoT.										
C2	Design IoT applications in different domain and be able to analyze their performance										
C3	Implement basic IoT applications on embedded platform										
C4	To gain knowledge on Industry Internet of Things										
C5	To Learn about the privacy and Security issues in IoT										
UNIT	**Details**							**No. of Hours**			

I	IoT& Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	12
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	12
III	IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	12
IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management	12
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects,	12

	Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO5

Text Book	
1	Vijay Madisetti and ArshdeepBahga, ―Internet of Things: (A Hands-on Approach)‖, Universities Press (INDIA) Private Limited 2014, 1st Edition.
Reference Books	
1.	Michael Miller, ―The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World‖, kindle version.
2.	Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, Apress Publications 2013, 1st Edition,.
3	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice‖ 4..CunoPfister, ―Getting Started with the Internet of Things‖, O‟Reilly Media 2011
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.javatpoint.com
3.	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	3
CO2	3	2	2	3	3	3
CO3	3	2	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	2
Weightage ofcoursecontributedtoeachPSO	15	12	11	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	SOFTWARE PROJECT MANAGEMENT	Elective	4	-	-	-	3	4	25	75	100

Learning Objectives		
LO1	To define and highlight importance of software project management.	
LO2	To formulate and define the software management metrics & strategy in managing projects	
LO3	To famialarize in Software Project planning	
LO4	Understand to apply software testing techniques in commercial environment	
Unit	**Contents**	**No. of Hours**
I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.	**12**

II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.	**12**
III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.	**12**
IV	Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	**12**
V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	**12**
TOTAL		**60**

CO	**Course Outcomes**
CO1	Understand the principles and concepts of project management
CO2	Knowledge gained to train software project managers
CO3	Apply software project management methodologies.
CO4	Able to create comprehensive project plans
CO5	Evaluate and mitigate risks associated with software development process

Textbooks

1	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, ―Quality Software Project Management‖, Pearson Education Asia 2002.

Reference Books

1.	PankajJalote, ―Software Project Management in Practice‖, Addison Wesley 2002.
2.	Hughes, ―Software Project Management‖, Tata McGraw Hill 2004, 3rd Edition.

NOTE: Latest Edition of Textbooks May be Used

Web Resources	
1.	Software Project Management e-resources from Digital libraries
2.	www.smartworld.com/notes/software-project-management

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**3**	**1**	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**3**
Weightageofcoursecontributed toeachPSO	**13**	**11**	**10**	**13**	**13**	**12**

S-Strong-3 M-Medium-2 L-Low-1

Subject	Subject Name	Cat	L	T	P	S	C	I	Marks

Code									CIA	External	Total
	Image Processing	Elective	4	-	-	-	3	4	25	75	100
Learning Objective											
LO1	To learn fundamentals of digital image processing.										
LO2	To learn about various 2D Image transformations										
LO3	To learn about various image enhancement processing methods and filters										
LO4	To learn about various classification of Image segmentation techniques										
LO5	To learn about various image compression techniques										

UNIT	Contents	No. of Hours
I	**Digital Image Fundamentals:** Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems - Mathematical Morphology- Structuring Elements- Morphological Image Processing - 2D Convolution - 2D Convolution Through Graphical Method -2D Convolution Through Matrix Analysis	12
II	2D Image transforms: Properties of 2D-DFT - Walsh transform - Hadamard transform- Haar transform- Discrete Cosine Transform- Karhunen-Loeve Transform -Singular Value Decomposition	12
III	Image Enhancement: Spatial domain methods- Point processing- Intensity transformations - Histogram processing- Spatial filtering- smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering- Homomorphic filter.	12
IV	Image segmentation: Classification of Image segmentation techniques - Region approach – Clustering techniques - Segmentation based on thresholding - Edge based segmentation - Classification of edges- Edge detection - Hough transform- Active contour.	12
V	Image Compression: Need for compression -Redundancy- Classification of image- Compression schemes- Huffman coding- Arithmetic coding- Dictionary based compression -Transform based compression,	12
	Total	**60**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Understand the fundamental concepts of digital image processing.	PO1
2	Understand various 2D Image transformations	PO1, PO2
3	Understand image enhancement processing techniques and filters	PO4, PO6
4	Understand the classification of Image segmentation techniques	PO4, PO5, PO6
5	Understand various image compression techniques	PO3, PO5
Text Book		
1	S Jayaraman, S Esakkirajan, T Veerakumar, Digital image processing ,Tata McGraw Hill, 2015	
2	Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009	
Reference Books		
1.	1. Jain Anil K , Fundamentals of digital image processing: , PHI,1988	
2.	Kenneth R Castleman , Digital image processing:, Pearson Education,2/e,2003	
3.	Pratt William K , Digital Image Processing: , John Wiley,4/e,2007	
Web Resources		
1.	https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf	
2.	http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf	
3.	https://dl.acm.org/doi/10.5555/559707	
4.	https://www.ijert.org/image-processing-using-web-2-0-2	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**2**	**2**

Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**10**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Human Computer Interaction	Elective	4	-	-	-	3	4	25	75	100
Learning Objectives											
LO1	To learn about the foundations of Human Computer Interaction.										
LO2	To learn the design and software process technologies.										
LO3	To learn HCI models and theories.										
LO4	To learn Mobile Ecosystem.										
LO5	To learn the various types of Web Interface Design.										

UNIT	**Contents**	**No. of Hours**
I	**FOUNDATIONS OF HCI :** • The Human: I/O channels – Memory • Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; • Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies	12
II	**DESIGN & SOFTWARE PROCESS:** • Interactive Design: • Basics – process – scenarios • Navigation: screen design Iteration and prototyping. • HCI in software process: • Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design	12
III	**MODELS AND THEORIES:** • HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.	12
IV	**Mobile HCI:** • Mobile Ecosystem: Platforms, Application frameworks • Types of Mobile Applications: Widgets, Applications, Games • Mobile Information Architecture, Mobile 2.0, • Mobile Design: Elements of Mobile Design, Tools. - Case Studies	12
V	**WEB INTERFACE DESIGN:** Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual	12

	Pages, Process Flow - Case Studies	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understand thefundementals of HCI.	PO1
CO2	Understand the design and software process technologies.	PO1, PO2
CO3	Understand HCI models and theories.	PO4, PO6
CO4	Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design.	PO4, PO5, PO5
CO5	Understand the various types of Web Interface Design.	PO3, PO4

Text Book	
1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ‖Human -Computer Interaction‖, III Edition, Pearson Education, 2004 (UNIT I, II & III)
2	Brian Fling, ―‖Mobile Design and Development‖, I Edition, O_Reilly Media Inc., 2009(UNIT–IV)
3	Bill Scott and Theresa Neil, ―Designing Web Interfaces‖, First Edition, O_Reilly, 2009. (UNIT-V)

Reference Books	
1.	Shneiderman, ―Designing the User Interface: Strategies for Effective Human-Computer Interaction‖, V Edition, Pearson Education.

Web Resources	
1.	https://www.interaction-design.org/literature/topics/human-computer-interaction
2.	https://link.springer.com/10.1007/978-0-387-39940-9_192
3.	https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	3	2
Weightage ofcoursecontributedtoeachPSO	15	14	11	15	11	10

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Fuzzy Logic	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
CO1	To understand the basic concept of Fuzzy logic
CO2	To learn the various operations on relation properties
CO3	To study about the membership functions
CO4	To learn about the Defuzzification and Fuzzy Rule-Based System
CO5	To learn the concepts of Applications of Fuzzy Logic

UNIT	Contents	No. of Hours
I	Introduction to Fuzzy Logic- Fuzzy Sets- Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation.	12
II	Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of	

	Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations ,Crisp Relation.	12
III	Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering.	12
IV	Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, DefuzzificationMethods, Fuzzy Rule-Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules.	12
V	Applications of Fuzzy Logic: Fuzzy Logic in Automotive Applications, Fuzzy Antilock Brake System-Antilock-Braking System and Vehicle Speed-Estimation Using Fuzzy Logic.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the basics of Fuzzy sets, operation and properties.	PO1
2	Apply Cartesian product and composition on Fuzzy relations and usethe tolerance and Equivalence relations.	PO1, PO2
3	Analyze various fuzzification methods and features of membership Functions.	PO4, PO6
4	Evaluate defuzzification methods for real time applications.	PO3, PO4, PO6
5	Design an application using Fuzzy logic and its Relations.	PO3, PO6

Text Book	
1	S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007.
Reference Books	
1.	Guanrong Chen and Trung Tat Pham- Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems
2.	Timothy J Ross , Fuzzy Logic with Engineering Applications
Web Resources	
1.	https://www.javatpoint.com/fuzzy-logic
2.	https://www.guru99.com/what-is-fuzzy-logic.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	2	3	2
Weightage ofcoursecontributedtoeachPSO	15	14	11	14	11	10

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Artificial Intelligence	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
C1	To learn various concepts of AI Techniques.
C2	To learn various Search Algorithm in AI.
C3	To learn probabilistic reasoning and models in AI.
C4	To learn about Markov Decision Process.
C5	To learn various type of Reinforcement learning.

UNIT	**Contents**	**No. of Hours**
I	Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree	12
II	Search Algorithms : Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search	12
III	Probabilistic Reasoning : Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.	12
IV	Markov Decision process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.	12
V	Reinforcement Learning : Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	

1	Understand the various concepts of AI Techniques.	PO1
2	Understand various Search Algorithm in AI.	PO1, PO2
3	Understand probabilistic reasoning and models in AI.	PO4, PO6
4	Understand Markov Decision Process.	PO4, PO5, PO6
5	Understand various type of Reinforcement learning Techniques.	PO3, PO4
Text Book		
1	Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖ , 3rd Edition, Prentice Hall.	
	Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Tata McGraw Hill	
Reference Books		
1.	Trivedi, M.C., ―A Classical Approach to Artifical Intelligence‖, Khanna Publishing House, Delhi.	
2.	SarojKaushik, ―Artificial Intelligence‖, Cengage Learning India, 2011	
3.	David Poole and Alan Mackworth, ―Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press 2010	
Web Resources		
1.	https://github.com/dair-ai/ML-Course-Notes	
2.	https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html	
3.	https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXlRFbcghLMZVwICm_4PkIRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage ofcoursecontributedto eachPSO	15	12	10	11	12	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Robotics and its Applications	Elective	4	-	-	-	3	4	25	75	100
Learning Objectives											
LO1	To understand the robotics fundamentals										
LO2	Understand the sensors and matrix methods										
LO3	Understand the Localization: Self-localizations and mapping										
LO4	To study about the concept of Path Planning, Vision system										
LO5	To learn about the concept of robot artificial intelligence										

UNIT	Details	No. of Hours	Course Objective
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	12	
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	12	
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	12	

IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	12
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the different physical forms of robot architectures.	PO1
CO2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
CO3	Mathematically describe a kinematic robot system	PO4, PO6
CO4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
CO5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8

Text Book	
1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011
Reference Books	
1.	Industrial robotic technology-programming and application by M.P.Grooveret.al, McGrawhill2008
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009
Web Resources	
1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm

2.	https://www.geeksforgeeks.org/robotics-introduction/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Computing Intelligence	Elective	4	-	-	-	3	4	25	75	100

Learning Objectives		
LO1	To identify and understand the basics of AI and its search.	
LO2	To study about the Fuzzy logic systems.	
LO3	Understand and apply the concepts of Neural Network and its functions.	
LO4	Understand the concepts of Artifical Neural Network	
LO5	To study about the Genetic Algorithm.	
UNIT	**Contents**	**No. of Hours**
I	**Introduction to AI**: Problem formulation – AI Applications – Problems – State Space and Search –	12

	Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	
II	**Fuzzy Logic Systems:** Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	12
III	**Neural Networks:** What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications	12
IV	**Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	12
V	**Genetic Algorithm:** Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the fundamentals of artificial intelligence concepts and searching techniques.	PO1
2	Develop the fuzzy logic sets and membership function and defuzzification techniques.	PO1, PO2

3	Understand the concepts of Neural Network and analyze and apply the learning techniques	PO4, PO6
4	Understand the artificial neural networks and its applications.	PO4, PO5, PO6
5	Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.	PO3, PO5
Text Book		
1	S.N. Sivanandam and S.N. Deepa, ―Principles of Soft Computing‖, 2nd Edition, Wiley India Pvt. Ltd.	
2	Stuart Russell and Peter Norvig, ―Artificial Intelligence - A Modern Approach‖, 2nd Edition, Pearson Education in Asia.	
3	S. Rajasekaran, G. A. Vijayalakshmi, ―Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications‖, PHI.	
Reference Books		
1.	F. Martin, Mcneill, and Ellen Thro, ―Fuzzy Logic: A Practical approach‖, AP Professional, 2000. Chin Teng Lin, C. S. George Lee,‖ Neuro-Fuzzy Systems‖, PHI	
2.	Chin Teng Lin, C. S. George Lee,‖ Neuro-Fuzzy Systems‖, PHI.	
Web Resources		
1.	https://www.javatpoint.com/artificial-intelligence-tutorial	
2.	https://www.w3schools.com/ai/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**

Weightage ofcoursecontributedto eachPSO	**15**	**12**	**10**	**11**	**12**	**13**					

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Grid Computing	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
LO1	To learn the basic construction and application of Grid computing.
LO2	To learn grid computing organization and their Role.
LO3	To learn Grid Computing Anotomy.
LO4	To learn Grid Computing road map.
LO5	To learn various type of Grid Architecture.

UNIT	**Contents**	**No. of Hours**
I	Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.	12
II	Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based solutions.	12
III	Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology.	12
IV	The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.	12
V	Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping#, Service message description Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I Organization.	12

	Total	60
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	To understand the basic elements and concepts of Grid computing.	PO1
CO2	To understand the Grid computing toolkits and Framework.	PO1, PO2
CO3	To understand the concepts of Anotomy of Grid Computing.	PO4, PO6
CO4	To understand the concept of service oriented architecture.	PO4, PO5
CO5	To Gain knowledge on grid and web service architecture.	PO3, PO5
Text Book		
1	Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004.	
Reference Books		
1.	Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003.	
Web Resources		
1.	https://en.wikipedia.org/wiki/Grid_computing	
2.	https://link.springer.com/chapter/10.1007/978-1-84882-409-6_4	
3.	https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**2**	**2**

Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**10**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Cloud Computing	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
LO1	Learning fundamental concepts and Technologies of Cloud Computing.
LO2	Learning various cloud service types and their uses and pitfalls.
LO3	To learn about Cloud Architecture and Application design.
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.
LO5	To learn the various Case Studies in Cloud Computing.

UNIT	**Contents**	**No. of Hours**
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.	12
II	Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute	12

	Engine - Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notifiction Services - Media Services Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network Analytics Services: Amazon Elastic MapReduce - Google MapReduce Service - Google BigQuery - Windows Azure HDInsight Deployment and Management Services: Amazon Elastic Beanstack - Amazon CloudFormation Identity and Access Management Services: Amazon Identiy and Access Management - Windows Azure Active Directory Open Source Private Cloud Software: CloudStack – Eucalyptus - OpenStack	
III	**Cloud Application Design:** Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: RelationalApproach (SQL), Non-RelationalApproach (NoSQL).	12
IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – WorkloadCharacteristics – Application Performance Metrics – Design Consideration for	12

	BenchmarkingMethodology – Benchmarking Tools and Types of Tests – DeploymentPrototyping. **Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data atrest, securing data in motion – Key Management – Auditing.	
V	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for EnergySystems - Cloud Computing for Transportation Systems - Cloud Computing for ManufacturingIndustry - Cloud Computing for Education.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO 1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
CO 2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
CO 3	Able to understand Cloud Architecture and Application design.	PO4, PO5
CO 4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
CO 5	Understand various Case Studies in Cloud Computing.	PO3, PO6

Text Book

1	ArshdeepBahga, Vijay Madisetti, *Cloud Computing – A Hands On Approach*, Universities Press (India) Pvt. Ltd., 2018

Reference Books

1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill, 2013.
2.	Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013.
3.	David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015.

4.	Dr. Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012.
Web Resources	
1.	https://en.wikipedia.org/wiki/Cloud_computing
2.	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7
3.	https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage ofcoursecontributedtoeachPSO	15	14	11	15	15	10

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Artificial Neural Networks	Elective	4	-	-	-	3	4	25	75	100
Learning Objectives											
LO1	**Understand the basics of artificial neural networks, learning process, single layer**										

	and multi-layer perceptron networks.	
LO2	Understand the Error Correction and various learning algorithms and tasks.	
LO3	Identify the various Single Layer Perception Learning Algorithm.	
LO4	Identify the various Multi-Layer Perception Network.	
LO5	Analyze the Deep Learning of various Neural network and its Applications.	
UNIT	**Contents**	**No. of Hours**
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.	12
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	12
III	.Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	12
IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	12
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications	12
	Total	**60**
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	

CO1	**Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.**	PO1
CO2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2
CO3	Learn the various Perception Learning Algorithm.	PO4, PO5
CO4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
CO5	Understand the Deep Learning of various Neural network and its Applications.	PO3, PO5
Text Book		
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition.	
2.	―Neural Network- A Comprehensive Foundation‖- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.	
Reference Books		
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.	
Web Resources		
1.	https://www.w3schools.com/ai/ai_neural_networks.asp	
2.	https://en.wikipedia.org/wiki/Artificial_neural_network	
3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**2**	**3**	**2**	**3**	**2**	**2**
Weightage ofcoursecontributedtoeach PSO	**14**	**14**	**11**	**15**	**10**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Introduction to Data Science	Elective	4	-	-	-	3	4	25	75	100
Learning Objectives											
LO1	To learn about basics of Data Science and Big data.										
LO2	To learn about overview and building process of Data Science.										
LO3	To learn about various Algorithms in Data Science.										
LO4	To learn about Hadoop Framework.										
LO5	To learn about case study about Data Science.										
UNIT	**Contents**										**No. of Hours**
I	**Introduction:** Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science										12
II	**The Data science process**:Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building .										12
III	**Algorithms** :Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised										12
IV	**Introduction to Hadoop** :Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types										12
V	**Case Study**: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation										12
	Total										**60**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Understand the basics in Data Science and Big data.	PO1
CO2	Understand overview and building process in Data Science.	PO1, PO2
CO3	Understand various Algorithms in Data Science.	PO3, PO6
CO4	Understand Hadoop Framework in Data Science.	PO4, PO5
CO5	Case study in Data Science.	PO3, PO5
Text Book		
1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, ―Introducing Data Science‖, manning publications 2016	
Reference Books		
1.	Roger Peng, ―The Art of Data Science‖, lulu.com 2016.	
2.	MurtazaHaider, ―Getting Started with Data Science – Making Sense of Data with Analytics‖, IBM press, E-book.	
3.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali,―Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools‖, Dreamtech Press 2016.	
4.	Annalyn Ng, Kenneth Soo, ―Numsense! Data Science for the Layman: No Math Added‖, 2017,1st Edition.	
5.	Cathy O'Neil, Rachel Schutt, ―Doing Data Science Straight Talk from the Frontline‖, O'Reilly Media 2013.	
6.	Lillian Pierson, ―Data Science for Dummies‖, 2017 II Edition	
Web Resources		
1.	https://www.w3schools.com/datascience/	
2.	https://en.wikipedia.org/wiki/Data_science	
3.	http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**

CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**11**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Agile Project Management	Elective	4	-	-	-	3	4	25	75	100

Learning Objectives	
LO1	Learning of software design, software technologies and APIs.
LO2	Detailed demonstration about Agile development and testing techniques.
LO3	Learning about Agile Planning and Execution.
LO4	Understanding of Agile Management Design and Quality Check.
LO5	Detailed examination of Agile development and testing techniques.

UNIT	**Contents**	**No. of Hours**
I	**Introduction:Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being	12

	Agile.	
II	**Being Agile** **Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary **Agile Environments in Action:** Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools. **Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy.	12
III	**Agile Planning and Execution** **Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog. **Planning Releases and Sprints:** Refining requirements and estimates – Release planning – Sprint planning. **Working Throughout the Day:** Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day. **Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective. **Preparing for Release:** Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment	12
IV	**Agile Management** **Managing Scope and Procurement:** What‘s different about Agile scope management – Managing Agile scope – What‘s different about	12

	Agile procurement – Managing Agile procurement. **Managing Time and Cost:** What's different about Agile time management – Managing Agile schedules – What's different about Agile cost management – Managing Agile budgets. **Managing Team Dynamics and Communication:** What's different about Agile team dynamics – Managing Agile team dynamics – What's different about Agile communication – Managing Agile communication. **Managing Quality and Risk:** What'sdifferent about Agile quality – Managing Agile quality – What's different about Agile risk management – Managing Agile risk.	
V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time. **Being a Change Agent:** Becoming Agile requires change – why change doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
CO2	Understanding of Agile development and testing techniques.	PO1, PO2
CO3	Understanding about Agile Planning and Execution using Sprint.	PO4, PO5

CO4	Understanding of Agile Management Design, scope, Procurement, managing Time and Cost and Quality Check.	PO4, PO5, PO6
CO5	Analysing of Agile development and testing techniques.	PO2, PO4
Text Book		
1	Mark C. Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018.	
	Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin, 2014.	
Reference Books		
1.	Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.	
2.	Mike Cohn, Succeeding with Agile – Software Development using Scrum, Addison-Wesley Signature Series, 2010.	
3.	Alex Moore, Agile Project Management, 2020.	
4.	Alex Moore, *Scrum*, 2020.	
5.	Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014.	
Web Resources		
1.	www.agilealliance.org/resources	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**11**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
	Virtual Reality	**4**	**-**	**-**	**-**	**3**	**4**	**25**	**75**	**100**

Learning Objectives		
LO1	To provide knowledge on basic principles of virtual & augmented reality	
LO2	To have the ability to use its technology as a platform for real-world applications.	
Unit	**Contents**	**No. of Hours**
I	Virtual Reality: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –Input Devices: Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces	12
II	Output Devices: Graphics Displays – Sound Displays – Haptic Feedback - Computer Architecture for VR: The Rendering Pipeline- PC Graphics Architecture - VR Programming: Toolkits and Scene Graphs – Traditional and Emerging Applications of VR	12
III	Augmented Reality: Introduction – Augmented Reality Concepts: Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience	12
IV	Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies	12
V	Augmented Reality Content: Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - Mobile Augmented Reality: Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality	12
	Total Hours	**60**
CO	**Course Outcomes**	
CO1	Outline the basic terminologies, techniques and applications of VR and AR	
CO2	Describe different architectures and principles of VR and AR systems	
CO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications	
CO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition	
CO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem	

Textbooks		
1.		Grigore C. Burdea and Philippe Coiffet, ―Virtual Reality Technology‖, Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9)
2.		Alan B. Craig(2013), ―Understanding Augmented Reality: Concepts and Applications‖(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8)
3.		Jon Peddie (2017), ―Augmented Reality: Where We Will All Live‖, Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)
Reference Books		
1.		Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), ―Developing Virtual Reality Applications: Foundations of Effective Design‖, Elsevier(Morgan Kaufmann Publishers)
2.		Paul Mealy (2018), ―Virtual and Augmented Reality‖, Wiley
3.		Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), ―Virtual Reality and Augmented Reality: Myths and Realities‖, Wiley
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.		http://msl.cs.uiuc.edu/vr/
2.		http://www.britannica.com/technology/virtual-reality/Living-in -virtual-worlds
3.		https://mobidev.biz/blog/augmented-reality-development-guide

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**15**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
	Data Analytics	**4**	**-**	**-**	**-**	**3**	**4**	**25**	**75**	**100**

Learning Objectives		
LO1	To study the basic inferential statistics and sampling distribution.	
LO2	To understand the concept of estimation of parameters using fundamental tests and testing of hypotheses.	
Unit	**Contents**	**No. of Hours**
I	Introduction Data Analytics – Data Analysis Vs Data Analytics – Data Analytics – Types - Data Analytics – Framework – Data Analytics – Tool - R language - Understanding R -features - Installing R and R Studio – Packages and Library	12
II	Importing and Exporting Files: CSV File – JSON File – txt File – Excel File – Xml File - Command Line Vs. Scripts. - Data Pre-Processing – Missing Value – Omitting Null Values – Data Transformation – Data Selection – Data Integration.	12
III	Command Line Vs. Scripts Data Manipulation: Slicing - Subscripts and Indices – Data Subset – Dplyr Package: Select Function - Filter Function - Mutate Function - Arrange Function.	12
IV	Data Summarization & Visualization - Mean – Median – Mode - Variablity Measures - Variance – Range - IQR – Standard Deviation – Sum of Squares –Identifying Outliers using IQR.	12
V	Data Analytics Case Studies – Marketing – Logistic Management – Insurance – Behavioral Analytics – Data Analytics on Diamond Dataset.	12
	Total Hours	**60**
CO	**Course Outcomes**	
CO1	Understand and critically apply the concepts and methods of analytics	
CO2	Analyze the concept of sampling	
CO3	Demonstrate the skills to perform various tests in the given data	
CO4	Apply the knowledge to derive hypotheses for given data	
CO5	Perform statistical analytics on a data set	
Textbooks		

1.		V. Bhuvaneswari, ―Data Analytics with R Step by Step‖, Scitech Publisher, ISBN – 978-81- 929131-2-4, Edition 2016.& 9)
2.		Roger D.Peng, ―R Programming for Data Science‖, Lean Publishing, 2014
3.		Vignesh Prajapati, ―Big Data Analytics with R and Hadoop‖, Packt Publishing, ISBN- 978-1- 78216-328-2, 2013.)
4		Sholom Weiss, et.al, ―The Text Mining Handbook: Advanced Approaches in Analysing Unstructured Data‖, Springer, Paperback 2010
5		Emmanuel Paradis, ―R for Beginners‖, 2005.
Reference Books		
1		Robert S. Witte and John S. Witte, ―Statistics‖, Eleventh Edition, Wiley Publications, 2017.
2		Allen B. Downey, ―Think Stats: Exploratory Data Analysis in Python‖, Green Tea Press, 2014.
3		David Spiegelhalter, ―The Art of Statistics: Learning from Data‖, Pelican Books, 2020.
Web Resources		
1		https://www.techtarget.com/searchdatamanagement/definition/data-analytics
2		https://careerfoundry.com/en/blog/data-analytics/what-is-data-analytics/
3		https://www.mastersindatascience.org/learning/what-is-data-analytics/

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**15**	**10**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Cognitive Science and Analytics	Elective	5	-	-	-	4	5	25	75	100
Course Objective											
C1	To explain cognitive computing and design principles										
C2	To distinguish between NLP and cognitive computing..										
C3	To apply advanced analytics to cognitive computing.										
C4	To discuss application of cognitive computing in business										
C5	To illustrate various applications of cognitive computing										
UNIT	**Contents**							**No. of Hours**			
I	Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition.							15			
II	Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.							15			
III	Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems							15			

IV	Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data	15
V	Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future.	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Apply cognitive computing and design principles.	PO1
2	Understand the concept NLP and cognitive computing.	PO1, PO3
3	Analyze advanced analytics to cognitive computing.	PO2, PO6
4	Discuss application of cognitive computing in business.	PO4, PO5, PO6
5	Evaluate the performance of analytical frameworks	PO5, PO6

Text Book

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, ―Cognitive computing and Big Data Analytics‖ Wiley, 2015. 2. Vijay Raghvan, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications‟, by Elsevier publications, North Holland Publication, 1st Edition, 2016.
3. Bernadette Sharp (Author), Florence Sedes (Author), Wieslaw Lubaszewski (Author), Cognitive Approach to Natural Language Processing Hardcover, First Edition May 2017.

Reference Books
1. Arun Kumar Sangaiah, Arunkumar Thangavelu, et al., Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and Communications Technologies 1st edition 2018 2. Min Chen and Kai Hwang, Big-Data Analytics for Cloud, IoT and Cognitive Computing Wiley Publication, 1st Edition, 2017. 3. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing‖, IGI Global Publishers, 2019

Web Resources	
1.	https://www.ulster.ac.uk/cognitive-analytics-research/cognitive-analytics#:~:text=Cognitive%20Analytics%20applies%20human%2Dlike,deep%20learning%20and%20machine%20learning.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	2	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	4
Weightageofcoursecontributedtoeach PSO	13	13	14	14	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject	Subject Name	Cat	L	T	P	S	C	I	Marks

Code									CIA	External	Total
	Internet of Things (IoT)	Elective	5	-	-	-	4	5	25	75	100
Course Objective											
C1	To explain about the definition and usage of Internet of things										
C2	To explain the key component sof IoT system										
C3	Able to understand the application areas of IOT										
C4	Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks										
C5	ble to understand building blocks of Internet of Things and characteristics.										

UNIT	**Contents**	**No. of Hours**
I	Introduction Definition and Characteristics of IoT ,Physical Design of IoT; Things in IOT, Logical Design of IoT ;IoT Functional Blocks,IoT Communication APIs, IoT Enabling Technologies; WSN ,CloudComputing, Big Data Analysis, Communication Protocols, Embedded Systems	15
II	IoT Hardware,Devices and Platforms– Basics of Arduino Hardware, The Arduino IDE,Basic Arduino Programming,Basics of Raspberrypi;Introduc tionto Raspberrypi, Programming with Raspberrypi, IoT Platforms,IoT Sensors and actuators	15
III	IoTProtocols– IoT Datalink Protocols,Network Layer Routing Protocols,Network Layer Encapsulation Protocols,Session Layer Protocols,IoT Security Protocols, Service Discovery Protocols,Infrastructure Protocols.	15

IV	IoT Programming – Arduino Programming: Serial Communications – Getting Input from Sensors,Visual,PhysicalandAudioOutputs,RemotelyControllingExternalDevices,WirelessCommunicat ion,	15
V	Domain Specific IoT – Home automation, smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, industry and Health & Life style sensors, Case Studies: ACase Study of Internet ofThings Using WirelessSensor Networks and Smart Phone.	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Explain the definition and usage of the term ―Internet of Thing s‖in different contexts.	PO1
2	Understand the key components that make up an IoT system	PO1, PO3
3	DifferentiatebetweenthelevelsoftheIoTstackandbefamiliarwiththekey Technologie sand protocols employed teach layer of the stack.	PO2, PO6
4	Applytheknowledgeandskillsacquiredduringthecourse tobuildandtesta complete,workingIoTsysteminvolvingprototyping,programminganddataanalysis	PO4, PO5, PO6
5	DiscoverwheretheIoTconceptfitswithinthebroaderICTindustryandpossible futuretrends	PO5, PO6

Text Book

VijayMadisetti andArshdeepBahga,―Internet ofThings(AHands-on-Approach)‖, 1st Edition,VPT, 2014

Reference Books
1. Margolis, Michael. ―ArduinoCooKbook: Receipestobegin, Expand and Enhance Your Projects‖.O,,ReillyMediaInc.2011. 2. Monk,Simon.RaspberryPiCookbook:SoftwareandhardwareproblemsandSolutions. O,,ReillyMedia,Inc.2016.

Web Resources	
1.	https://www.tutorialspoint.com/internet_of_things/index.htm

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	2	2	2
CO3	2	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	4
Weightageofcoursecontributedtoeach PSO	13	13	14	13	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject	Subject Name	Cat	L	T	P	S	C	I	Marks

Code									CIA	External	Total
	Data Visualization	Elective	5	-	-	-	4	5	25	75	100
Course Objective											
C1	To introduce the concept of Data Visualization										
C2	To explain the various techniques in Data Visualization										
C3	To introduce students to the fundamental problems										
C4	Able to realize concepts, and approaches in the design and analysis of data visualization systems.										
C5	Able to understand building blocks of Data.										

UNIT	Contents	No. of Hours
I	Introduction-contextofdatavisualization-definitionmethodology,visualizationdesignobjectives.Key factors-purpose, visualization function and tone, visualization design options- data representation, data presenation, seven stages of data visualization, widgets, data visualization tools.	15
II	Visualizingdatamethods-mapping,timeseries-connectionsandcorrelations-scatterplotmaps-trees, Hierachiesan drecursion- networks naadgraphs, infographics	15
III	Visualizing data process- acquiring data, where to find data, tools of acquiring data from the internet, locating file for use with processing, loading text data, dealing with files and folders, lisiting files in a folder, asynchronous image downloads, advanced web techniques, using a database, dealing with large number offiles.	15

IV	Interactive data visualization-drawing with data, scales-axes-updates, transaction and modeinteractivity-layouts-geomapping-exportingframework-T3lstabio	15
V	Securitydatavisualization-portscanvisualization-vulnerabilityassessmentandexploitation-firewall logvisualization-instructiondetectionlogvisualization-attackinganddefendingvisualizationsystemscreatingsecurityvisualization system	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the basics of data visualization.	PO1
2	Understand the importance fdatavisualization and the design and use of many visual components	PO1, PO3
3	Explain the process of data visualization	PO2, PO6
4	Explain the basics of interactive data visualization techniques visualization-based issues.	PO4, PO5, PO6
5	Understand the concept of various types of visulaization	PO5, PO6

Text Book

ScottMurray,‖interactivedatavisualizationfortheweb―,O‖Reillymedia,inc,2013

Reference Books

1. Benfry,‖visualizingdata‖,O‖Reillymedia,inc,2007

2 .Greg conti,‖ security data visualization:‖,‖graphical techniques for network analysis‖, Nostarchpress inc,2007

Web Resources	
1.	https://www.tutorialspoint.com/business_writing_skills/data_visualization.htm#:~:text=Data%20Visualization%20is%20used%20to,accessible%2C%20understandable%2C%20and%20usable.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	2	2	2
CO3	2	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	4	3	4
Weightageofcoursecontributedtoeach PSO	13	13	14	14	14	14

S-Strong-3 M-Medium-2 L-Low-1

Annexure - II

Skill Enhancement Course (SEC1-SEC8)

Subject Code	Subject Name	Category	L	T	P	S	Inst. hours	Credits	Marks		
									CIA	External	Total
	Fundamentals of Information Technology	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

Learning Objectives		
LO1		Understand basic concepts and terminology of information technology.
LO2		Have a basic understanding of personal computers and their operation
LO3		Be able to identify data storage and its usage
LO4		Get great knowledge of software and its functionalities
LO5		Understand about operating system and their uses

UNIT		**Contents**	**No. Of. Hours**
I		**Introduction to Computers:** Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer	**6**
II		**Basic Computer Organization:** Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.	**6**
III		**Storage Fundamentals:** Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives	**6**
IV		**Software:** Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W	**6**

		and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	
V		**Operating System:** Functions, Measuring System Performance, Assemblers, Compilers and Interpreters.Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	**6**
		TOTAL HOURS	**30**

	Course Outcomes	**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1		Anoop Mathew, S. KavithaMurugeshan (2009), ― Fundamental of Information Technology‖, Majestic Books.
2		Alexis Leon, Mathews Leon,‖ Fundamental of Information Technology‖, 2nd Edition.
3		S. K Bansal, ―Fundamental of Information Technology‖.

Reference Books

1.		BhardwajSushilPuneet Kumar, ―Fundamental of Information Technology‖
2.		GG WILKINSON, ―Fundamentals of Information Technology‖, Wiley-Blackwell
3.		A Ravichandran , ―Fundamentals of Information Technology‖, Khanna Book Publishing

Web Resources

1.		https://testbook.com/learn/computer-fundamentals
2.		https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html
3.		https://www.javatpoint.com/computer-fundamentals-tutorial
4.		https://www.tutorialspoint.com/computer_fundamentals/index.htm
5.		https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	INTRODUCTION TO HTML	Skill Enha. Course (SEC)	2	-	-		2	25	75	100
Learning Objectives										
LO1	Insert a graphic within a web page.									
LO2	Create a link within a web page.									
LO3	Create a table within a web page.									
LO4	Insert heading levels within a web page.									

LO5	Insert ordered and unordered lists within a web page. Create a web page.	
UNIT	**Contents**	**No. Of. Hours**
I	Introduction :WebBasics: WhatisInternet–Webbrowsers–WhatisWebpage – HTMLBasics:Understandingtags.	**6**
II	TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headingsparagraph(<p> tag)– Fontstyleelements:(bold,italic,font,small,strong,strike,bigtags)	**6**
III	Lists:Typesoflists:Ordered,Unordered– NestingLists– Othertags:Marquee,HR,BR-UsingImages –CreatingHyperlinks.	**6**
IV	Tables:CreatingbasicTable,Tableelements,Caption–Tableandcellalignment– Rowspan,Colspan–Cellpadding.	**6**
V	Frames:Frameset–TargetedLinks–Noframe–Forms:Input, Textarea,Select,Option.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO 1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO 2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO 3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO 4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
CO 5	Concept of adding images Understand the table creation.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	—Mastering HTML5 and CSS3 Made Easy‖, TeachUComp Inc., 2014.
2	**Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"**

Web Resources

1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf

2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
	WEB DESIGNING	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	Understand the basics of HTML and its components
LO2	To study about the Graphics in HTML
LO3	Understand and apply the concepts of XML and DHTML
LO4	Understand the concept of JavaScript
LO5	To identify and understand the goals and objectives of the Ajax

UNIT	Details	No. of Hours
I	HTML: HTML-Introduction-tag basics- page	

	structure-adding comments working with texts, paragraphs and line break. Emphasizing test-heading and horizontal rules-list-font size, face and color-alignment links-tables-frames.	6
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page.	6
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	6
IV	Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition,	6
V	Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.	6
	Total	**30**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Develop working knowledge of HTML	PO1, PO3, PO6, PO8

CO2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	PO1,PO2,PO3,PO6
CO3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	PO3, PO5
CO4	Ability to develop a java script	PO1, PO2, PO3, PO7
CO5	An ability to develop web application using Ajax.	P02, PO6, PO7
Text Book		
1	Pankaj Sharma, ―Web Technology‖, SkKataria& Sons Bangalore 2011.	
2	Mike Mcgrath, ―Java Script‖, Dream Tech Press 2006, 1st Edition.	
3	Achyut S Godbole&AtulKahate, ―Web Technologies‖, 2002, 2nd Edition.	
Reference Books		
1.	Laura Lemay, RafeColburn , Jennifer Kyrnin, ―Mastering HTML, CSS &Javascript Web Publishing‖, 2016.	
2.	DT Editorial Services (Author), ―HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)‖, Paperback 2016, 2nd Edition.	
Web Resources		
1.	NPTEL & MOOC courses titled Web Design and Development.	
2.	https://www.geeksforgeeks.org	

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**

CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	PHP PROGRAMMING	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

Learn ing Objectives		
LO1	To provide the necessary knowledge on basics of PHP.	
LO2	To design and develop dynamic, database-driven web applications using PHP version.	
LO3	To get an experience on various web application development techniques.	
LO4	To learn the necessary concepts for working with the files using PHP.	
LO5	To get a knowledge on OOPS with PHP.	
UNIT	**Contents**	**No. of Hours**
I	Introduction to PHP -Basic Knowledge of websites - Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation	6
II	PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP. Introduction to PHP Variable -Understanding Data Types - Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement.	6
III	Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions. PHP Functions -Creating an Array -Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions.	6
IV	PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File.	6

V	Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Write PHP scripts to handle HTML forms	PO1,PO4,PO6
CO2	Write regular expressions including modifiers, operators, and metacharacters.	PO2,PO5,PO7.
CO3	Create PHP Program using the concept of array.	PO3,PO4,PO5.
CO4	Create PHP programs that use various PHP library functions	PO2,PO3,PO5
CO5	Manipulate files and directories.	PO3,PO5,PO6.

Text Book	
1	Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.
2	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes
Reference Books	
1.	PHP: The Complete Reference-Steven Holzner.
2.	DT Editorial Services (Author), ―*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*‖, Paperback 2016, 2nd Edition.
Web Resources	
1.	Opensource digital libraries: PHP Programming
2.	https://www.w3schools.com/php/default.asp

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**1**	**2**

CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	SoftwareTesting	Skill Enha. Course (SEC)	Y	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	To study fundamental concepts in software testing
LO2	To discuss various software testing issues and solutions in software unit test, integration and system testing.
LO3	To study the basic concept of Data flow testing and Domain testing.
LO4	To Acquire knowledge on path products and path expressions.
LO5	To learn about Logic based testing and decision tables

UNIT	**Contents**	**No. of Hours**
I	Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.	6

II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques.	6
III	Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing.	6
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions.SyntaxTesting– Formats–Test Cases	6
V	Logic Based Testing–Decision Tables– Transition Testing–States, State Graph, StateTesting.	6
	Total	**30**

Course Outcomes		**Program Outcomes**
CO	On completion of this course, students will	
CO1	Students learn to apply software testing knowledge and engineering methods	PO1
CO2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	PO1, PO2
CO3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	PO4, PO6
CO4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	PO4, PO5, PO6
CO5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8

Text Book	
1	B.Beizer,—SoftwareTestingTechniques‖,IIEdn.,DreamTechIndia,NewDelhi, 2003.
2	K.V.K.Prasad,—SoftwareTestingTools‖,DreamTech.India,NewDelhi,2005
Reference Books	
1.	I.Burnstein,2003,—PracticalSoftwareTesting‖,SpringerInternationalEdn.

2.	E. Kit, 1995, —Software Testing in the Real World: Improving the Process‖, PearsonEducation,Delhi.
3.	R. Rajani,andP.P.Oak,2004,—SoftwareTesting‖,TataMcgrawHill,New Delhi.
Web Resources	
1.	https://www.javatpoint.com/software-testing-tutorial
2.	https://www.guru99.com/software-testing.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	UNDERSTANDING INTERNET	Skill Enha. Course (SEC)	2	-	-		2	25	75	100
Learning Objectives										

LO1	Knowledge of Internet medium
LO2	Internet as a mass medium
LO3	Features of Internet Technology,
LO4	Internetassourceof infotainment
LO5	Studyofinternet audiences andabout cyber crime

UNIT	Contents	No. Of. Hours
I	Theemergenceofinternetasamassmedium–theworldof_worldwideweb‘.	**6**
II	Featuresofinternetasatechnology.	**6**
III	Internetasasourceofinfotainment – classificationbasedoncontentandstyle.	**6**
IV	Demographic and psychographic descriptions of internet _audiences‘ – effect of internet onthevalues and life-styles.	**6**
V	Presentissuessuchascybercrimeandfuturepossibilities.	**6**
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Knows the basic concept in internet Concept of mass medium and world wide web	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows the concept of internet as a technology.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the concept of infotainment and classification based on content and style	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Can be able to know about Demographic and psychographic description of internet	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand the concept of cyber crime and future possibilities	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	01. Barnouw, E and Krishnaswamy S [1990] Indian Film. New York, OUP.
2	Kumar, Keval [1999] Mass Communication in India. Mumbai, Jaico.
3	Srivastava, K M [1992] Media Issues. Sterling Publishers Pvt Ltd.

Reference Book

1	Acharya, R N [1987] Television in India. Manas Publications, New Delhi.
2	Barnouw, E [1974] Documentary – A History of Nonfiction. Oxford, OUP
3	Luthra, H R [1986] Indian Broadcasting. Ministry of I& B, New Delhi.
4	Vasudev, Aruna [1986] The New Indian Cinema. Macmillan India, New Delhi.

Web Resources

1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SEC1	**OFFICE AUTOMATION**	Skill Enha. Course (SEC)	**2**	-	-	-	2	2	25	75	100
Learning Objectives											
LO1	Understand the basics of computer systems and its components.										
LO2	Understand and apply the basic concepts of a word processing package.										
LO3	Understand and apply the basic concepts of electronic spreadsheet software.										
LO4	Understand and apply the basic concepts of database management system.										

LO5	Understand and create a presentation using PowerPoint tool.	
UNIT	**Contents**	**No. of Hours**
I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner.Outputdevices:Monitor,Printer.IntroductiontoOperatingsystems &itsfeatures:DOS– UNIX–Windows. IntroductiontoProgrammingLanguages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets;SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers,numbering;printing–Preview,options,merge.	6
III	**Spreadsheets:**Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying;Charts–creating,formatting and printing,analysistables,preparationoffinancialstatements,introductiont odataanalytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files,Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applicationsinquerylanguage(MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting &viewingslides – creating slide shows. Applying special object – including objects & pictures – Slidetransition–Animationeffects,audioinclusion,timers.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6,PO8
CO2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
CO3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
CO4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
CO5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8

Text Book

1	PeterNorton,―IntroductiontoComputers‖–TataMcGraw-Hill.
Reference Books	
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, ―Microsoft 2003‖, Tata McGrawHill.
Web Resources	
1.	https://www.udemy.com/course/office-automation-certificate-course/
2.	https://www.javatpoint.com/automation-tools

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**14**	**14**	**15**	**15**	**15**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Quantitative Aptitude	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100
Learning Objectives											

LO1	To understand the basic concepts of numbers	
LO2	Understand and apply the concept of percentage, profit & loss	
LO3	To study the basic concepts of time and work, interests	
LO4	To learn the concepts of permutation, probability, discounts	
LO5	To study about the concepts of data representation, graphs	
UNIT	**Contents**	**No. of Hours**
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers.	6
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule.	6
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surface area -races and Games of skill.	6
IV	Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series.	6
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts-Line graphs.	6
	Total	**60**
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	understand the concepts, application and the problems of numbers	PO1
CO2	To have basic knowledge and understanding about percentage, profit & loss related processings	PO1, PO2
CO3	To understand the concepts of time and work	PO4, PO6
CO4	Speaks about the concepts of probability, discount	PO4, PO5
CO5	Understanding the concept of problem solving involved in stocks & shares, graphs	PO3, PO6

Text Book	
1	—QuantitativeAptitude‖,R.S.AGGARWAL.,S.Chand&CompanyLtd.,
Reference Books	
1.	
Web Resources	
1.	https://www.javatpoint.com/aptitude/quantitative
2.	https://www.toppr.com/guides/quantitative-aptitude/

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**2**	**3**	**1**	**3**	**2**	**2**
CO3	**1**	**3**	**1**	**1**	**3**	**1**
CO4	**1**	**2**	**1**	**1**	**3**	**1**
CO5	**1**	**2**	**1**	**1**	**3**	**3**
Weightage of course contributed to each PSO	**8**	**12**	**5**	**8**	**13**	**9**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Multimedia Systems	Skill Enha.	2	-	-	-	2	2	25	75	100

		Course (SEC)									

Learning Objectives	
LO1	Understand the definition of Multimedia
LO2	To study about the Image File Formats, SoundsAudio File Formats
LO3	Understand the concepts of Animation and Digital Video Containers
LO4	To study about the Stage of Multimedia Project
LO5	Understand the concept of Ownership of Content Created for Project Acquiring Talent

UNIT	Contents	No. of Hours	Course Objective
I	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text: About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.	6	
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound -DigitalAudio-MidiAudio-Midivs.DigitalAudio-MultimediaSystemSoundsAudio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project	6	
III	Animation: The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips -Shooting and Editing Video	6	
IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs-Multimedia Production Team.	6	
V	Planning and Costing: The Process of Making Multimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content andTalent:AcquiringContent-OwnershipofContentCreatedforProject-AcquiringTalent	6	

	Total	30
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	understand the concepts, importance, application and the process of developing multimedia	PO1
CO2	to have basic knowledge and understanding about image related processings	PO1, PO2
CO3	To understand the framework of frames and bit images to animations	PO4, PO6
CO4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
CO5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO6
Text Book		
1	TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill,2001.	
Reference Books		
1.	RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication& Applications",PearsonEducation,2012.	
Web Resources		
1.	https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/	

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**2**	**2**	**3**	**3**	**3**	**2**
CO2	**2**	**3**	**2**	**3**	**2**	**1**
CO3	**1**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**2**	**2**	**1**	**2**
CO5	**2**	**3**	**1**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**10**	**12**	**11**	**14**	**12**	**10**

Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Advanced Excel	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	Handle large amounts of data
LO2	Aggregate numeric data and summarize into categories and subcategories
LO3	Filtering, sorting, and grouping data or subsets of data
LO4	Create pivot tables to consolidate data from multiple files
LO5	Presenting data in the form of charts and graphs

UNIT	Contents	No. of Hours
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting	6

	and Filtering Data -Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	6
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- What If Analysis - Goal Seek- Data Tables- Scenario Manager.	6
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Work with big data tools and its analysis techniques.	PO1
CO2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2

CO3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
CO4	Perform analytics on data streams.	PO4, PO5, PO6
CO5	Learn No-SQL databases and management.	PO3, PO8
Text Book		
1	**Excel 2019 All**	
2	**Microsoft Excel 2019 Pivot Table Data Crunching**	
Reference Books		
1	Excel 2019 All-in-One for Dummies, Greg Harvey, 1st edition	
Web Resources		
1.	https://www.simplilearn.com	
2	https://www.javatpoint.com	
3	https://www.w3schools.com	

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**2**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**15**	**15**	**15**

Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	I	Total
	Biometrics	Specific Elective	2	-	-	-	2	2	25	75	100

Learning Objectives		
LO1	Identify the various biometric technologies.	
LO2	Design of biometric recognition.	
LO3	Develop simple applications for privacy	
LO4	Understand the need of biometric in the society	
LO5	Understand the scope of biometric techniques	
UNIT	**contents**	**No. of Hours**
I	**Introduction**: What is Biometrics, History, Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods. **Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System, Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, .7 Face Recognition Methods, Advantages and Disadvantages.	6
II	**Retina and Iris Biometrics:** Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris Recognition System, Iris Segmentation Method , Determination of Iris Region, Determination of Iris Region, Applications of Iris Biometrics, Advantages and Disadvantages **Vein and Fingerprint Biometrics:** Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae	6

	Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages.	
III	**Privacy Enhancement Using Biometrics:** Introduction, Privacy Concerns Associated with Biometric Deployments, Identity and Privacy, Privacy Concerns, Biometrics with Privacy Enhancement, Comparison of Various Biometrics in Terms of Privacy, Soft Biometrics. **Multimodal Biometrics:** Introduction to Multimodal Biometrics , Basic Architecture of Multimodal Biometrics, Multimodal Biometrics Using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, Characteristics and Advantages of Multimodal Biometrics.	6
IV	**Watermarking Techniques:** Introduction, Data Hiding Methods, Basic Framework of Watermarking, Classification of Watermarking, Applications of Watermarking, Attacks on Watermarks, Performance Evaluation, Characteristics of Watermarks, General Watermarking Process, Image Watermarking Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking.	6
V	**Scope and Future:** Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques. **Biometric Standards:** Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability.	6

	Total	**30**
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	To understand the basic concepts and the functionality of the Biometrics, Face Biometrics, Types, Architecture and Applications.	PO1, PO3, PO6, PO8
CO2	To know the concepts Retina and Iris Biometrics and Vein and Fingerprint Biometrics.	PO1,PO2,PO3,PO6
CO3	To analyse the Privacy Enhancement and Multimodal Biometrics.	PO3, PO5
CO4	To get analyticalidea on Watrmarking Techniques	PO1, PO2, PO3, PO7
CO5	To Gain knowledge on Future scope of Biometrics,and Study of various Biometric Techniques.	PO2, PO6, PO7
Recommended Text		
1.	Biometrics: Concepts and Applications by G.R Sinha and SandeepB.Patil , Wiley, 2013	
References Books		
1.	Guide to Biometrics by Ruud M. Bolle , SharathPankanti, Nalinik.Ratha, Andrew W.Senior, Jonathan H. Connell , Springer 2009	
2.	Introduction to Biometrics by Anil k. Jain, Arun A. Ross, KarthikNandakumar	
3.	Hand book of Biometrics by Anil K. Jain, Patrick Flynn, ArunA.Ross.	
Web Resources		
1.	https://www.tutorialspoint.com/biometrics/index.htm	
2.	https://www.javatpoint.com/biometrics-tutorial	
3.	https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics	

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**1**
CO3	**2**	**2**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**1**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**13**	**11**	**9**	**14**	**14**	**10**

Strong-3M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Cyber Forensics	Skill Enha.	2	-	-	-	2	2	25	75	100

		Course (SEC)									

Learning Objectives		
LO1	Understand the definition of computer forensics fundamentals.	
LO2	To study about the Types of Computer Forensics Evidence	
LO3	Understand and apply the concepts of Duplication and Preservation of Digital Evidence	
LO4	Understand the concepts of Electronic Evidence and Identification of Data	
LO5	To study about the Digital Detective, Network Forensics Scenario, Damaging Computer Evidence.	
UNIT	**Contents**	**No. of Hours**
I	**Overview of Computer Forensics Technology:** Computer Forensics Fundamentals: What is Computer Forensics Use of ComputerForensics in Law Enforcement, Computer Forensics Assistance to HumanResources/Employment Proceedings, Computer Forensics Services, Benefits of professionalForensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer.Forensics Technology: Types of Business Computer Forensic, Technology–Types ofMilitary Computer Forensic Technology–Types of Law Enforcement–Computer Forensic. Technology–Types of Business Computer Forensic Technology.	6
II	**Computer Forensics Evidence and capture:** Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back –up in Data Recovery, The Data –Recovery Solution. Evidence Collection and Data Seizure: Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody.	6

III	**Duplication and Preservation of Digital Evidence:** Processing steps, Legal Aspects of collecting and Preserving Computerforensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation.	6
IV	**Computer Forensics Analysis:** Discovery of Electronic Evidence: ElectronicDocument Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices.	6
V	**Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats,Unusable File Formats, Converting Files.Networks: Network Forensics Scenario, a technical approach, Destruction Of E–Mail, Damaging Computer Evidence, DocumentingThe Intrusion on Destruction of Data, System Testing.	6
	Total	**30**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the definition of computer forensics fundamentals.	PO1
CO2	Evaluate the different types of computer forensics technology.	PO1, PO2
CO3	Analyze various computer forensics systems.	PO4, PO6
CO4	Apply the methods for data recovery, evidence collection and data seizure.	PO4, PO5, PO6
CO5	Gain your knowledge of duplication and preservation of digital evidence.	PO3, PO8
Text Book		
1	John R. Vacca, ―Computer Forensics: Computer Crime Investigation‖, 3/E ,Firewall	

	Media, New Delhi, 2002.
Reference Books	
1.	Nelson, Phillips Enfinger, Steuart,―Computer Forensics and Investigations‖ Enfinger, Steuart, CENGAGE Learning, 2004.
2.	Anthony Sammes and Brian Jenkinson,‖Forensic Computing: A Practitioner's Guide‖, Second Edition, Springer–Verlag London Limited, 2007.
3.	.Robert M.Slade,‖ Software Forensics Collecting Evidence from the Scene of a Digital Crime‖, TMH 2005.
Web Resources	
1.	https://www.vskills.in
2.	https://www.hackingarticles.in/best-of-computer-forensics-tutorials/

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**1**
CO3	**3**	**2**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**1**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**14**	**12**	**9**	**14**	**14**	**10**

Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Pattern Recognition	Skill Enha. Course (SEC)	2	-	-	-	2	2	75	25	100

Learning Objectives			
LO1	To learn the fundamentals of Pattern Recognition techniques		
LO2	To learn the various Statistical Pattern recognition techniques		
LO3	To learn the linear discriminant functions and unsupervised learning and clustering		
LO4	To learn the various Syntactical Pattern recognition techniques		
LO5	To learn the Neural Pattern recognition techniques		
UNIT	**Contents**	**No. of Hours**	**Course Objective**
I	**PATTERN RECOGNITION OVERVIEW**: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches	6	CO1
II	**STATISTICAL PATTERN RECOGNITION**: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.	6	CO2
III	**LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING**: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification	6	CO3
IV	**SYNTACTIC PATTERN RECOGNITION**: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition-Learning via grammatical inference.	6	CO4
V	**NEURAL PATTERN RECOGNITION**: Introduction	6	CO5

	to Neural Networks-Feed-forward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR		
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	understand the concepts, importance, application and the process of developing Pattern recognition over view	PO1
CO2	to have basic knowledge and understanding about parametric and non-parametric related concepts.	PO1, PO2
CO3	To understand the framework of frames and bit images to animations	PO4, PO6
CO4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4, PO5, PO6
CO5	Understanding the concept of cost involved in multimedia planning, designing, and producing	PO3, PO8

Text Book	
1	Robert Schalkoff, ―Pattern Recognition: Statistical Structural and Neural Approaches‖, John wiley& sons.
2	Duda R.O., P.E.Hart& D.G Stork, ― Pattern Classification‖, 2nd Edition, J.Wiley.
3	Duda R.O.& Hart P.E., ―Pattern Classification and Scene Analysis‖, J.wiley.
4	Bishop C.M., ―Neural Networks for Pattern Recognition‖, Oxford University Press.
Reference Books	
1.	1. Earl Gose, Richard johnsonbaugh, Steve Jost, ―Pattern Recognition and Image Analysis‖, Prentice Hall of India, Pvt Ltd, New Delhi.
Web Resources	
1.	https://www.geeksforgeeks.org/pattern-recognition-introduction/
2.	https://www.mygreatlearning.com/blog/pattern-recognition-machine-learning/

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**2**	**2**	**2**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**2**

CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**2**
Weightage of course contributed to each PSO	**15**	**15**	**12**	**12**	**13**	**10**

Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Enterprise Resource Planning	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

Learning Objectives		
LO1	To understand the basic concepts, Evolution and Benefits of ERP.	
LO2	To know the need and Role of ERP in logical and Physical Integration.	
LO3	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management	
LO4	To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth	
LO5	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills	
UNIT	**Details**	**No. of Hours**
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP	6

	Packages.	
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Man-agement (PLM), LAP, Supply chain Management.	6
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Quality Management, Material Management, Financial Module, CRM and Case Study.	6
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre-Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	6
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6
	Total	**30**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of ERP.	PO1, PO2, PO6
CO2	Identify different technologies used in ERP	PO2, PO3, PO4
CO3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	PO1, PO3, PO6
CO4	Discuss the benefits of ERP	PO2, PO6
CO5	Apply different tools used in ERP	PO1, PO3, PO5

Reference Text :	
1.	Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.
References :	
1.	Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
2.	Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia
Web Resources	
1.	1. https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm
2.	1. https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/
3.	1. https://www.guru99.com/erp-full-form.html
4.	2. https://www.oracle.com/in/erp/what-is-erp/

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**3**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**3**
Weightage of course contributed to each PSO	**15**	**15**	**14**	**12**	**13**	**11**

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Simulation and Modeling	Skill Enha.	2	-	-	-	2	2	25	75	100

		Course (SEC)									

Learning Objectives		
LO1	Generates computer simulation technologies and techniques, lays the groundwork for students to comprehend computer simulation requirements, and implements and tests a variety of simulation and data analysis libraries and programmes. This course focuses on what is required to create simulation software environments rather than just simulations using pre-existing packages	
LO2	Discuss the concepts of modelling layers of critical infrastructure networks in society.	
LO3	Create tools for viewing and controlling simulations and their results.	
LO4	Understand the concept of Entity modelling, Path planning	
LO5	To learn about the Algorithms and Modelling.	
UNIT	**Details**	**No. of Hours**
I	Introduction To Modeling & Simulation – What is Modeling and Simulation – Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms -Probability Distributions - Selecting a Probability Distribution.	6
II	Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method –Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions-Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors - Mean, Standard Deviation and Confidence Interval - Analysis of Finite-Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal of	6

	Initialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method .	
III	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach.	6
IV	Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling – General AI Algorithms - Decision Trees - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution.	6
V	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	6
	Total	**30**

Course Outcomes

Course Outcomes	On completion of this course, students will;	**Programme Outcomes**
CO1	Introduction To Modeling & Simulation, Input Data	PO1

	Analysis and Modeling.	
CO2	Random Variate and Number Generation. Analysis of Simulations and methods.	PO1, PO2
CO3	Comparing Systems via Simulation	PO4, PO6
CO4	Entity Body Modeling, Visualization, Animation.	PO4, PO5, PO6
CO5	Algorithms and Sensor Modeling.	PO3, PO5
Text Books		
1.	Jerry Banks, ―Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice‖, John Wiley & Sons, Inc., 1998.	
2.	George S. Fishman, ―Discrete-Event Simulation: Modeling, Programming and Analysis‖, Springer-Verlag New York, Inc., 2001.	
References Books		
1.	Andrew F. Seila, Vlatko Ceric, PanduTadikamalla, ―Applied Simulation Modeling‖, Thomson Learning Inc., 2003.	
Web Resources		
1.	https://www.tutorialspoint.com/modelling_and_simulation/index.htm	
2.	https://www.javatpoint.com/verilog-simulation-basics	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	**3**	**2**	**2**	**3**	**3**	**2**
CO 2	**3**	**3**	**2**	**3**	**3**	**2**
CO 3	**3**	**3**	**3**	**3**	**3**	**2**
CO 4	**3**	**3**	**2**	**3**	**3**	**2**
CO 5	**3**	**3**	**2**	**3**	**3**	**2**
	15	**14**	**11**	**15**	**15**	**10**

Strong-3M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**O**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Internet Basics	Skill Enha.	2	-	-	-	2	2	25	75	100

	Laboratory	Course (SEC)									

Learning Objectives		
LO1	Introduce the fundamentals of Internet and the Web functions	
LO2	Impart knowledge and essential skills necessary to use the internet and its various components.	
LO3	Find ,evaluate ,and use online information resources.	
LO4	Use Google Apps for education effectively.	
EX NO:	**Contents**	**No. of Hours**
1	Create an email account in Gmail. Using the account created compose a mail to invite other college students for your college fest, enclose the invitation as attachment and send the mail to at least 10recipients.Use CC and BCC options accordingly	3
2	Open your inbox in the Gmail account created, check the mail received from your peer from other college inviting you for his college fest, and download the invitation. Reply to the mail with a thank you note for the invite and forward the mail to other friends	3
3	Assumethatyouarestudyinginfinalyearofyourgraduationandareeagerlylookingforajob.Visit Any job port a land upload your resume	3
4	Create a label and upload bulk contacts using import option in Google Contacts	3
5	Create one-pages to try in your mother tongue by using voice recognition facility of Google Docs	3
6	Create your own Google classroom and inviteall your friends throughemailed.Post study material in Google class roo musing Google drive. Createa separate folder for every subject and upload all unit wise EContent Material	3
7	Create and share a folder in Google Drive using_sharealink,,option and set the permission to access That folder by your friends only	3
8	Create a meet using Google Calendar and record the meet using Google Meet.	3
9	Create a registration form for your Department Seminar or Conference using Google Forms	3
10	Create a question paper with multiple choice types of questions for asubject of your choice,using Google Forms.	**30**
Course Outcomes		

Course Outcomes	On Completion of the course the students will	Program Outcomes
CO1	Introduce the fundamentals of Internet and the Web functions	PO1, PO2, PO6
CO2	Impart knowledge and essential skills necessary to use the internet and its various components.	PO2,PO4. PO5, PO6
CO3	Find ,evaluate ,and use online information resources.	PO1, PO2, PO4, PO5, PO6
CO4	Use Google Apps for education effectively.	PO2, PO3, PO4 PO5,
Text Books		
1.	IanLamont,GoogleDrive&Docsin30Minutes, 2nd Edition	
References Books		
1.	Sherry Kinkoph Gunter ,My Google Apps, 2014.	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
CC6	**Internet Programming Lab**	Skill Enha. Course (SEC)	-	-	4	-	4	4	25	75	100
Learning Objectives											
LO1	To introduce the concepts of Object Oriented Programming Paradigm and the Programming constructs of JAVA										
LO2	Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.										
LO3	Read and make elementary modifications to Java programs that solve real-world problems.										

LO4	Validate input in a Java program. .	
LO5	Document a Java program using Javadoc. .	
	Details	**No. of Hours**
	List of Exercises:	
1	Write a Java Applications to extract a portion of a character string and print the extracted string.	60
2	Write a Java Program to implement the concept of multiple inheritance using Interfaces	
3	Write a Java Program to create an Exception called payout-of-bound sand throw the exception	
4 **5**	Write a Java Program to implement the concept of multi the reading with the use of any three multiplication tables and assign three different priorities to them. Write a Java Program to draw several shapes in the created windows	
6	Write a Java Program to demonstrate the Multiple Selection List-box.	
7	Write a Java Program to create a frame with three text fields for name ,age and qualification and a text Field for multiple line for address	
8	Write a Java Program to create Menu Bars and pull down menus	
9	Write a Java Program to create frames which respond to the mouse clicks.	
10	Write a Java Program to draw circle ,square ,ellipse and rectangle at the mouse click positions	

	Total	**60**
Course Outcomes		**Programmeme Outcome**
CO	On completion of this course, students will	
CO1	Apply the various basic programming constructs of JAVA like decision makingstatements.	PO1
CO2	Looping statements, overloading, inheritance, polymorphism, constructors And destructors	PO1,PO2
CO3	Illustrate the concepts of the reading and multi-threading.	PO4,PO6
CO4	Design programs using various file stream classes;file types ,and frames.	PO4,PO5,PO6
CO5	An exposure to create real time applications using JAVA	PO3,PO5
Text Book		
1	Programming with Java–A Primer-E. Balagurusamy,3rd Edition, TMH.	
Reference Books		
1.	The Complete ReferenceJava2-PatrickNaughton&Hebert Schildt,3rd Edition, TMH	
Web Resources		
1.	E-content from open source libraries	
2.	https://www.sanfoundry.com/java-programming-examples/	