U18

THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE–632115

B.Sc. COMPUTER SCIENCE

SYLLABUS

FROM THE ACADEMIC YEAR

2023 – 2024

1. Introduction

B.Sc. Computer 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 Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Programme Outcome, Programme Specific Outcome and Course Outcome

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. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The

Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

2. Programme Outcomes (PO) of B.Sc. degree programme in Computer 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.
- Mould the students into responsible citizens in a rapidly changing interdependent society.

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: Modern tool usage

PO6: Applying to society

3. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science

PSO1: Think in a critical and logical based manner

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 real-time application related sciences.

PSO3: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PSO4: Understand, formulate, develop programming model with logical approaches to a Address issues arising in social science, business and other contexts.

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

PSO6: Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

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

PSO8: Develop a range of generic skills helpful in employment, internships& societal activities.

PSO9: Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of computing sciences.

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	• Instil confidence among students • Create interest for the subject

	concepts to real world.	
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
II year Vacation activity	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 Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	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	Hrs	Sem II	Credit	Hrs	Sem III	Credit	Hrs	Sem IV	Credit	Hrs	Sem V	Credit	Hrs	Sem VI	Credit	Hrs
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	6	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	5	2.5 Elective II Generic/ Discipline Specific	3	6	3.5 Elective III Generic/ Discipline Specific	3	5	4.5 Elective IV Generic/ Discipline Specific	3	6	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.	2	2				5.8 Summer Internship /Industrial Training	2				
	23	**32**		**23**	**32**		**24**	**32**		**23**	**32**		**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	16
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
		23	**32**

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	16
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		23	**32**

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	15
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	2	2
		24	**32**

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	16
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
		23	**32**

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
		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
		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.

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

Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	CC5 – Python Programming	5	5
	CC6 - Python Programming Lab	5	5
	Elective Courses(EC3):(Choose one from the following list)		
	i) Statistical Methods and their Applications – I	3	
	ii) Physics-I		5
Part-4	**Skill Enhancement Course -SEC-4** Fundamentals of Information Technology	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) Understanding Internet	2	2
	Environmental Studies	**2**	2
		24	**32**

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]		
	CC7 –Java Programming	5	5
	CC8 - Practical: Java Programming Lab	5	5
	Elective Courses(EC4):(Choose one from the following list)		
	i) Statistical Methods and their Applications – II	3	
	ii) Physics-II		6
Part-4	**Skill Enhancement Course -SEC-6** Web Designing	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific) Cyber Forensics	2	2
		23	**32**

Semester-V

Part	List of Courses	Credit	No. of Hours
Part -3	CC9 –Operating System	3	4
	CC10 –Operating System Lab	3	4
	CC11 - Data Base Management System	3	4
	CC12- Practical: Data Base Management System Lab	3	3
	Elective Courses(EC5):(Choose one from the following list)		
	i) Introduction to Data Science	3	4
	ii) Artificial Intelligence		
	iii) Computer Networks		
	Elective Courses(EC6):(Choose one from the following list)		
	i) Data Mining and warehousing	3	4
	ii) Mobile Computing		
	iii) Natural Language Processing		
	CC13 - Project with Viva voce	4	5
Part-4	Value Education	2	2
	Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-
	Total	**26**	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part -3	CC14 –Machine Learning	3	4
	CC15 - Machine Learning Lab	3	4
	CC16 - Data Analytics using R programming	3	5
	CC17- Practical: Data Analytics using R programming Lab	3	5
	Elective Courses(EC7):(Choose one from the following list)		
	i) IOT and its Applications	3	5
	ii) Cloud Computing		
	iii) Software Project Management		
	Elective Courses(EC8):(Choose one from the following list)		
	i) Software Testing	3	5
	ii) Cryptography		
	iii) Robotics and its Applications		
Part-4	**Skill Enhancement Course - SEC8** Open Source Technology	2	2
Part-5	Extension Activity	1	-
	Total	**21**	**30**

SEMESTER – III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Python programming	**Core**	5	-	-	-	5	25	75	100

Learning Objectives	
LO1	To make students understand the concepts of Python programming.
LO2	Understanding Decision and Looping statements, Functions
LO3	To impart knowledge on list, tuples, and dictionaries.
LO4	To apply the OOPs concept in PYTHON programming.
LO5	To know the file handling and GUI Program

UNIT	**Contents**	**No. of Hours**
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods.	**15**
II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.**	**15**
III	**Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments-Recursion. **Python Strings:** String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement-The Python module – dir() function – Modules and Namespace – Defining our own modules.	**15**
IV	**Lists:** Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. **Dictionaries:** Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	**15**
V	**Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	PO1, PO2, PO3, PO4,

		PO5, PO6
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of function, function arguments, Implementing the concept of List, tuples and dictionary	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Basic concept of Object Oriented Programming : Class , Object and Inheritance	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of File handlings in python, Concept of GUI programs.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Ashok Kamthane et.al, Programming and Problem Sovling with Python, 2nd Edition, TMH
2	Reema Thareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press

Reference Books

1.	Vamsi Kurama, "Python Programming: A Modern Approach", Pearson Education.
2.	Mark Lutz, "Learning Python", Orielly.
3.	Adam Stewarts, "Python Programming", Online.
4.	Fabio Nelli, "Python Data Analytics", APress.
5.	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.

Web Resources

1.	https://www.programiz.com/python-programming
2.	https://www.guru99.com/python-tutorials.html
3.	https://www.w3schools.com/python/python_intro.asp
4.	https://www.geeksforgeeks.org/python-programming-language/
5.	https://en.wikipedia.org/wiki/Python_(programming_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	3	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	14	15	15	13	14

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Python Programming Lab	**Core**	-	-	5	-	5	25	75	100

Learning Objectives	
LO1	Be able to design and program Python applications.
LO2	Be able to create loops and decision statements in Python.
LO3	Be able to work with functions and pass arguments in Python.
LO4	Be able to build and package Python modules for reusability.
LO5	Be able to read and write files in Python.

LAB EXERCISES	**Required Hours**
1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional / Loops / Jump Statements. 4. Program using Functions. 5. Program using Recursion. 6. Program using Arrays. 7. Program using Strings. 8. Program using Modules. 9. Program using Lists. 10. Program using Tuples. 11. Program using Dictionaries. 12. Program for File Handling.	**60**

Course Outcomes	
On completion of this course, students will	
CO1	Demonstrate the understanding of syntax and semantics of PYTHON language
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON program for a given problem and test for its correctness.

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	Inst. hours	Credits	Marks		
									CIA	External	Total
	Statistical Methods and their Applications-I	Elective	2	-	-	-	4	3	25	75	100

Learning Objectives		
LO1		Understand basic concepts of Statistical Methods
LO2		Have a basic understanding of measures of location
LO3		Have a basic understanding of measures of dispersion
LO4		Understand about Measures of skewness
LO5		Understand about correlation

UNIT		**Contents**	**No. Of. Hours**
I		Introduction - scope and limitations of statistical methods - classification of data - Tabulation of data- Diagrammatic and Graphical representation of data - Graphical determination of Quartiles ,Deciles and Percentiles.	**6**
II		Measures of location: Arithmetic mean, median, mode, geometric mean and Harmonic mean and their properties.	**6**
III		Measures of dispersion: Range, Quartile deviation, mean deviation, Standard deviation, combined Standard deviation, and their relative measures.	**6**
IV		Measures of Skewness: Karl Pearson's, Bowley's, and kelly's and co-efficient of Skewness andkurtosis based on moments.	**6**
V		Correlation - Karl Pearson - Spearman's Rank correlation - concurrent deviation methods.Regression Analysis:Simple Regression Equations.	**6**
		TOTAL HOURS	**30**

	Course Outcomes	**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of statistical methods	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Understanding of measures of location	PO1, PO2, PO3, PO4, PO5, PO6
CO3	understanding of measures of dispersion	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Understand about Measures of skewness	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand about correlation	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks		
1		Fundamental of Mathematical Statistics-S.C.Gupta &V.K.Kapoor-SultanChand
2		Statistical Methods-Snedecor G.W.& Cochran W.G.oxford &+DII
Reference Books		
1.		Elements of Statistics -Mode. E.B.-Prentice Hall
2.		Statistical Methods-Dr.S.P.Gupta-Sultan Chand &Sons
Web Resources		
1.		https://www.simplilearn.com/what-is-statistical-analysis-article

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	Inst. hours	Credits	Marks		
									CIA	External	Total
	Fundamentals of Information Technology	Skill Enha. Course (SEC)	2	-	-	-	1	1	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 and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	**6**
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	
O1	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
O2	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
O4	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.		P.Rizwan Ahmed, Introduction to Information Technology, 2nd Edition, Margham Publications, 2017

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
SEC5	**Understanding Internet**	Skill Enha. Course (SEC)	2	-	-		2	25	75	100

Learning Objectives	
LO1	Knowledge of Internet
LO2	Learning TCP/IP – Internet Technologies and Protocol
LO3	Learning Internet connectivity.
LO4	Learning internet networks
LO5	Learning Electronic Mail

UNIT	**Contents**	**No. Of. Hours**
I	Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, ARPANET and Internet history of the World Wide Web, basic Internet Terminology, Net etiquette. Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society Crime on/through the Internet.	**6**
II	Packet switching technology, Internet Protocols: TCP/IP, Router, Internet Addressing Scheme: Machine Addressing (IP address), E-mail Addresses, Resources Addresses	**6**
III	Internet accounts by ISP: Telephone line options, Protocol options, Service options, Telephone line options – Dialup connections through the telephone system, dedicated connections through the telephone system, ISDN, Protocol options – Shell, SLIP, PPP, Service options – E-mail, WWW, News Firewall	**6**
IV	Network definition, Common terminologies: LAN, WAN, Node, Host, Workstation,bandwidth, Interoperability, Network administrator, network security, Network Components: Severs, Clients, Communication Media, Types of network: Peer to Peer,Clients Server, Addressing in Internet: DNS, Domain Name and their organization	**6**
V	Email Networks and Servers, Email protocols –SMTP, POP3, IMAp4, MIME6, Structure of an Email – Email Address, Email Header, Body and Attachments	**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 internet.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Know the concept of TCP/IP – Internet Technologies and Protocol	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the concept of Internet connectivity.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Can be able to know about internet networks	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand the concept of Electronic mail.	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	Greenlaw R and Hepp E "Fundamentals of Internet and www" 2nd EL, Tata McGrawHill,2007.
2	D. Comer, "The Internet Book", Pearson Education, 2009
	Reference Book
1	M. L. Young,"The Complete reference to Internet", Tata McGraw Hill, 2007.
2	B. Patel & Lal B. Barik, " Internet & Web Technology ", Acme Learning Publishers.
3	Leon and Leon, "Internet for Everyone", Vikas Publishing House.
	Web Resources
1.	https://www.geeksforgeeks.org/what-is-internet-definition-uses-working-advantages-and-disadvantages/

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

SEMESTER – IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Ext	Total
	Java Programming	Core	5	-	-	-	5	5	25	75	100

Learning Objectives	
LO1	To provide fundamental knowledge of object-oriented programming
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to use AWT controls, Event Handling and Swing for GUI.
LO4	To provide fundamental knowledge of object-oriented programming.
LO5	To equip the student with programming knowledge in Core Java from the basics up.

UNIT	Contents	No. of Hours
I	**Introduction:** Review of Object Oriented concepts – History of Java – Java buzz words – JVM architecture – Data types - Variables - Scope and life time of variables - arrays - operators – control statements - simple java program - constructors - methods - Static block - Static Data – Static Method String and String Buffer Classes.	15
II	**Inheritance**: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes – **Packages**: Definition- Access Protection –Importing Packages. **Interfaces**: Definition– Implementation– Extending Interfaces. **Exception Handling**: *try – catch- throw - throws – finally* – Built-in-exceptions	15
III	**Multithreaded Programming**: Thread Class - Runnable interface – Synchronization– Using synchronized methods– Using synchronized statement- Inter thread Communication. **I/O Streams:** Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.	15
IV	**AWT Controls:** The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Color - Fonts and layout	15

	managers. **Event Handling:** Events - Event sources - Event Listeners - Handling Mouse and Keyboard Events - Adapter classes - Inner classes	
V	**Swing:** Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel,JTextField - JTextArea - JList - JComboBox - JScrollPane.	15
	Total	**75**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1, PO2, PO6
CO2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO2, PO3, PO8
CO3	Implement multi-threading and I/O Streams of Core Java	PO1, PO3, PO5
CO4	Implement AWT and Event handling.	PO2, PO6
CO5	Use Swing to create GUI.	PO1, PO3, PO6

Text Books:	
1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals,* Addison Wesley, 1999
References :	
1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010
3.	P.Rizwan Ahmed, Java Programming, 3rd Edition, Margham Publications, 2017
Web Resources	
1.	https://javabeginnerstutorial.com/core-java-tutorial
2.	http://docs.oracle.com/javase/tutorial/
3.	https://www.coursera.org/

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**	**1**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**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
	Java Programming Lab	Core	-	-	4	-	5	5	25	75	100

Learning Objectives	
LO1	To provide fundamental knowledge of object-oriented programming.
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to know about Event Handling .
LO4	To enable the students to use String Concepts.
LO5	To equip the student with programming knowledge in to creat GUI using AWT controls.

EXCERCISE	Details
1	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer
2	Write a Java program to multiply two given matrices.
3	Write a Java program that displays the number of characters, lines and words in a text
4	Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.
5	Write a program to do String Manipulation using Character Array and perform the following string operations: a. String length b. Finding a character at a particular position c. Concatenating two strings
6	Write a program to perform the following string operations using String class: a. String Concatenation b. Search a substring c. To extract substring from given string
7	Write a program to perform string operations using String Buffer class: a. Length of a string b. Reverse a string c. Delete a substring from the given string
8	Write a java program that implements a multi-thread application that

	has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	60
9	Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread2.	
10	Write a program to demonstrate the use of following exceptions. a. Arithmetic Exception b. Number Format Exception c. Array Index Out of Bound Exception d. Negative Array Size Exception	
11	Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes	
12	Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.	
13	Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).	
14	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.	
15	Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1
2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO1, PO2
3	Implement multi-threading and I/O Streams of Core Java	PO4, PO6
4	Implement AWT and Event handling.	PO4, PO5, PO6
5	Use Swing to create GUI.	PO3, PO6
Text Book		
1	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition,	

	2010.
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals,* Addison Wesley, 1999.
Reference Books	
1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.
Web Resources	
1.	https://www.w3schools.com/java/
2.	http://java.sun.com
3.	http://www.afu.com/javafaq.html

Mapping with Programme Outcomes:

S-Strong M-Medium L-Low

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**

Subject Code	Subject Name	Category	L	T	P	S	Inst. hours	Credits	Marks		
									CIA	External	Total
	Statistical Methods and their Applications-II	Elective	2	-	-	-	3	3	25	75	100

Learning Objectives		
LO1		Understand basic concepts of curve fitting.
LO2		Have a basic understanding of Sample Space
LO3		Have a basic understanding of standard distribution
LO4		Understand about Test of Significance
LO5		Understand about Analysis of variance

UNIT		**Contents**	**No. Of. Hours**
I		Curve fitting by the methods of least squares- Y= ax+ b,Y= ax2+ bx+ c,Y= axb,Y =a e bxandY=abx	**6**
II		SampleSpace-events-probability-AdditionandMultiplicationTheorem-conditionalprobability - Baye's Theorem. Mathematical expectation Addition and Multiplication theorem,Chebychev's Inequality.	**6**
III		Standard distributions-Binomial, Poisson, Normal distribution and fittingof these distributions.	**6**
IV		Test of Significance-small sample and large sample test based on mean,S.D.correlation and proportion- confidence interval.	**6**
V		Analysis of variance-One and Two way classifications-Basic principle of design of Experiments- Randomisation, Replication and Local control-C.R.D.,R.B.D.and L.S.D	**6**
		TOTAL HOURS	**30**

	Course Outcomes	**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of curve fitting methods.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Understanding of Sample Space	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understanding of standard distribution	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Understand about Test of Significance	PO1, PO2, PO3, PO4, PO5, PO6

CO5	Understand about Analysis of variance	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks		
1		Fundamental of Mathematical Statistics-S.C.Gupta &V.K.Kapoor-SultanChand
2		Statistical Methods-Snedecor G.W.& Cochran W.G.oxford &+DII
Reference Books		
1.		Elements of Statistics -Mode.E.B.-Prentice Hall
2.		Statistical Methods-Dr.S.P.Gupta-Sultan Chand &Sons

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.	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”, Sk Kataria& 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
	Cyber Forensics	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

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 Computer Forensics in Law Enforcement, Computer Forensics Services,. Types of Computer. Forensics Technology: Types of Business Computer Forensic, Technology–Types of Military Computer Forensic Technology–Types of Law Enforcement–Computer Forensic.	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.	6
III	**Duplication and Preservation of Digital Evidence:** Processing steps, Legal Aspects of collecting and Preserving Computer forensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication.	6
IV	**Computer Forensics Analysis:** Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical	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.	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

SEMESTER – V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Operating Systems	Core	Y	-	-	-	4	5	25	75	100
Course Objective											
LO1	Understanding the design of the Operating System										
LO2	Imparting knowledge on CPU scheduling, Process and Memory Management.										
LO3	To code specialized programs for managing overall resources and operations of the computer.										
LO4	To study about the concept of Job and processor scheduling										
LO5	To learn about te concept of memory organization and multiprogramming										

UNIT	Details	No. of Hours	Course Objective
	Introduction: operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation. **Process concepts:** definition of process, process states-Life cycle of a process, process management- process state transitions, process control block(PCB), process operations , suspend and resume, context switching, Interrupts -Interrupt processing, interrupt classes, Inter process communication-signals, message passing.	15	CO1
II	**Asynchronous concurrent processes:** mutual exclusion- critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson's algorithm,software solutions to the mutual Exclusion Problem-, n-thread mutual exclusion- Lamports Bakery Algorithm. Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores, counting semaphores, implementing semaphores. **Concurrent programming:** monitors, message passing	15	CO2
III	**Deadlock and indefinite postponement:** Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra's Banker's algorithm, deadlock detection, deadlock recovery.	15	CO3
IV	**Job and processor scheduling:** scheduling levels, scheduling objectives, scheduling criteria, preemptive vs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms-FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling.	15	CO4
V	**Real Memory organization and Management:**: Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation, single user	15	CO5

	contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming, Memory swapping **Virtual Memory organization:** virtual memory basic concepts, multilevel storage organization, block mapping, paging basic concepts, segmentation, paging/segmentation systems. **Virtual Memory Management:** Demand Paging, Page replacement strategies		
	Total	**75**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Define the fundamentals of OS and identify the concepts relevant to process , process life cycle, Scheduling Algorithms, Deadlock and Memory management	PO1
2	know the critical analysis of process involving various algorithms, an exposure to threads and semaphores	PO1, PO2
3	Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock. .	PO4, PO6
4	Have complete knowledge of Scheduling Algorithms and its types.	PO4, PO5, PO6
5	understand memory organization and management	PO3, PO8
Text Book		
1	H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011	
Reference Books		
1.	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.	
2.	A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Ninth Edition, John Wiley &Sons(ASIA) Pte Ltd.,2012	
3.	P.Rizwan Ahmed, Operating System, Margham Publications, 2019	
Web Resources		
1.	https://www.tutorialspoint.com/operating_system/index.htm	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	-	1	2	-	1
CO 2	2	3	1	2	-	1
CO 3	3	2	-	3	-	1
CO 4	1	3	1	1	3	2
CO 5	3	-	1	3	2	1
WEIGHTAGE OF COURSE CONTRIBUTED	12	8	4	11	5	6

TO EACH PSO						

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
CC10	**Operating System lab**	Core	-	-	5	-	4	3	25	75	100

Learning Objectives	
LO1	. To learn about the basics of UNIX commands and shell programming
LO2	To understand the programming knowledge of scheduling algorithms.
LO3	To understand the working of semaphores in operating system
LO4	To understand how to code various algorithm used in operating system.
LO5	To understand how to code and working procedure of file management concepts in operating system.

	List of Exercises:	**No. of Hours**	**Course Objective**
	1.Shell Programming. 2. Implement the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority 3. Implement all file allocation strategies a) Sequential b) Indexed c) Linked 4. Implement Semaphore 5. Implement all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG 6. Implement Bankers Algorithm for Dead Lock Avoidance 7. Implement an Algorithm for Dead Lock Detection 8. Implement e all page replacement algorithms a) FIFO b) LRU c) LFU 9. Implement Shared memory and IPC 10. Implement Paging Technique of memory management. 11. Implement Threading & Synchronization Applications.	3	60 Hrs
	Total		

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Able to understand the basics of UNIX commands and shell programming.	PO1
CO2	Able to understand the programming knowledge of scheduling algorithms.	PO1, PO2
CO3	Able to understand the working of semaphores in operating system	PO4, PO6
CO4	Able to understand how to code various algorithm used in	PO4, PO5, PO6

	operating system.	
CO5	. Able to understand how to code and working procedure of file management concepts in operating system.	PO3, PO4
Text Book		
1	H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011	
2	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.	
Reference Books		
1.	A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Nineth Edition, John Wiley &Sons(ASIA) Pte Ltd.,2012	
Web Resources		
1.	Web resources from NDL Library, E-content from open-source libraries	

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

Learning Objectives	
LO1	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO2	To understood the concepts of data base management system, design simple Database models
LO3	To learn and understand to write queries using SQL, PL/SQL.
LO4	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO5	To understood the concepts of data base management system, design simple Database models

UNIT	**Contents**	**No. of Hours**
I	**Database Concepts:**Database Systems - Data vs Information - Introducing the database -File system - Problems with file system – Database systems. Data models - Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction	15
II	**Design Concepts:** Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships -data redundancy revisited -indexes - codd's rules. Entity relationship model - ER diagram	15
III	**Normalization of Database Tables**: Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form. **Introduction to SQL**: Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables.	15

IV	**Advanced SQL**:Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join.**Sub Queries and Correlated Queries**: WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function	15
V	**PL/SQL**:A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation –Arithmetic operators.**Control Structures and Embedded SQL**: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. **PL/SQL Cursors and Exceptions**: Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT…FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions.	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.	PO1
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.	PO1, PO2
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4, PO6
CO4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.	PO4, PO5, PO6
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions	PO3, PO5

Text Book

1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management",

	Ninth Edition
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
Reference Books	
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition
2.	Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition
3.	P.Rizwan Ahmed, RDBMS, Margham Publications, 2016
Web Resources	
1.	Web resources from NDL Library, E-content from open-source libraries

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
CC11	**Database Management System lab**	Core	-	-	5	-	4	5	25	75	100

Learning Objectives	
LO1	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO2	To understood the concepts of data base management system, design simple Database models
LO3	To learn and understand to write queries using SQL, PL/SQL.
LO4	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO5	To understood the concepts of data base management system, design simple Database models

	List of Exercises:	**No. of Hours**	**Course Objective**
II	***I. SQL*** 1. DDLCOMMANDS 2. DMLCOMMANDS 3. TCLCOMMANDS ***II. PL/SQL*** 4. FIBONACCI SERIES 5. FACTORIAL 6. STRING REVERSE 7. SUM OF SERIES 8. TRIGGER ***III. CURSOR*** 9. STUDENT MARK ANALYSIS USING CURSOR ***IV. APPLICATION*** 10. LIBRARY MANAGEMENTSYSTEM 11. STUDENT MARK ANALYSIS		75

	Total		75
Course Outcomes		**Programme Outcomes**	
CO	On completion of this course, students will		
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.	PO1	
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.	PO1, PO2	
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4, PO6	
CO4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.	PO4, PO5, PO6	
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions	PO3, PO4	
Text Book			
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition		
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016		
Reference Books			
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition		
2.	Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition		
Web Resources			
1.	Web resources from NDL Library, E-content from open-source libraries		

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**1**	**2**	**2**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**2**	**2**	**3**	**3**	**3**	**1**
CO5	**2**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributedto each PSO	**12**	**12**	**13**	**14**	**14**	**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
EC5	**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
EC5	**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.
2.	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
3.	P.Rizwan Ahmed, Artificial Intelligence, Margham Publications, 2014
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
EC5	**Computer Networks**	Core	5	-	-	-	3	4	25	75	100

Course Objective	
LO1	To learn the basic concepts of Data communication and Computer network
LO2	To learn about wireless Transmission
LO3	To learn about networking and data link layer.
LO4	To study about Network communication.
LO5	To learn the concept of Transport layer

UNIT	Contents	No. of Hours
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media	15
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	15
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth.	15
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	15
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transporet Protocols (ITP) - Network Security: Cryptography	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models	PO1
CO2	To gain knowledge on Telephone systems using wireless network	PO1, PO2
CO3	To understand the concept of MAC	PO4, PO6
CO4	To analyze the characteristics of Routing and	PO4, PO5, PO6

	Congestion control algorithms	
CO5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	PO3, PO4
Text Book		
1	A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.	
Reference Books		
1.	B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017	
2.	F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008	
3.	D. Bertsekas and R. Gallagher, "Data Networks", 2nd Edition, PHI, 2008.	
4.	Lamarca, "Communication Networks", Tata McGraw- Hill, 2002	
Web Resources		
1.	https://en.wikipedia.org/wiki/Computer_network	
2.	https://citationsy.com/styles/computer-networks	

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	Inst. Hours	Marks		
									CIA	External	Total
EC6	**Data mining and warehousing**	Elective	5	-	-	-	3	4	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 Association Rules from Relational Database and Data Warehouses.	15	
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	
3.	P Rizwan Ahmed, Data Warehousing and Data Mining, Margham Publications, 2014	
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**
Weightageof coursecontributedtoeach 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
EC6	Mobile Computing	Core	5	-	-	-	3	4	25	75	100

Learning Objectives	
LO1	To provide the knowledge on wireless communication fundamentals
LO2	To study the basic concepts of medium access control and telecommunication system
LO3	To study a set of wireless networks
LO4	To study about mobile network layer.
LO5	To study the basic concepts of wireless application protocol

UNIT	**Contents**	**No. of Hours**	**Course Objectives**
I	Introduction–Applications–A short History of wireless Communications–Wireless Transmission – Frequencies for Radio transmission–Signals–Antennas–Signal Propagation– Multiplexing–Modulations–Amplitude shift keying–Frequency shift keying–Phase shift keying–Spread Spectrum	15	
II	SDMA–FDMA–TDMA–Fixed TDM–Classical Aloha–CDMA–Global System for Mobile Communications –GPRS–Satellite Systems –Basics –Applications–Broadcast Systems – Digital Audio Broadcasting – Digital Video Broadcasting. learn development of applications in mobile computing platform.	15	
III	Infrared vs. Radio Transmission– Infrastructure Networks–Ad hoc Networks – IEEE 802.11 –System Architecture–Protocol Architecture–Bluetooth–User scenarios–Bluetooth Architecture–Introduction to Wireless ATM –Services–Location Reference Model	15	
IV	Mobile IP–Goals– Assumption–Entities and Terminology– IP Packet delivery – Agent advertisement and discovery–Registration–Tunnelling and encapsulation–Optimizations– Dynamic Host Configuration Protocol (DHCP) – Routing –DSDV–DSR – Alternative Metrics	15	
V	Introduction–Protocol Architecture–Wireless Markup Language (WML)–WML Script– Applications–Wireless Telephony Application (WTA) – Wireless Telephony Application Architecture	15	
	Total	**75**	

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	To understand basic concepts of mobile computing.	PO1, PO3, PO6, PO8
CO2	To learn the basics of mobile telecommunication system	PO1,PO2,PO3,PO6
CO3	To comprehend wireless LAN and cellular systems.	PO3, PO5
CO4	To understand protocols at network and transport layer	PO1, PO2, PO3, PO5
CO5	To understand protocols at network and transport layer	PO2, PO4, PO6
Text Books (Latest Editions)		
1.	"Mobile Communications", Jochen Schiller –PHI/Pearson Education, Second Edition, 2003	
References Books (Latest editions)		
1.	"Principles of Wireless Networks", KavehPahalavan, PrasanthKrishnamoorthy, PHI/Pearson Education, 2003	
2.	" Mobile Computing", Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal – Tata McGraw Hill Publications, Second edition, 2010	
3.	P Rizwan Ahmed, Mobile Computing, Margham Publications, 2014	

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	Marks		
								CIA	External	Total
	Natural Language Processing	**Elective**	4	-	-		3	25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.
LO4	To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	**12**
II	**Word level and Syntactic Analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.	**12**
III	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.	**12**
IV	**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.	**12**
V	**Information retrieval and lexical resources:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame NetStemmers- POS Tagger- Research Corpora SSAS.	**12**
Total hours		**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each Use NLP technologies to explore and gain a broad understanding oftext data.	PO1, PO2, PO3, PO4, PO5, PO6

CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	Daniel Jurafsky, James H. Martin, "Speech & language processing", Pearson publications.
2	Allen, James. Natural language understanding. Pearson, 1995.
Reference Books	
1.	Pierre M. Nugues, "An Introduction to Language Processing with Perl and Prolog",Springer
Web Resources	
1.	https://en.wikipedia.org/wiki/Natural_language_processing
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP

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	2	3
CO 3	3	3	3	3	3	3
CO 4	3	2	3	3	2	3
CO 5	3	3	3	3	3	3
WeightageofcoursecontributedtoeachPSO	14	14	15	15	13	15

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	Project with Viva voce		4	-	-		4	25	75	100

Learning Objectives	
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience
LO3	Collaborate within and across disciplinary boundaries to solve problems
LO4	Apply mathematical and/or statistical methods to facilitate problem solving.

LO5	Exercise computational thinking over the entire software life cycle

Project Work

SL	Area of Work	Maximum Marks
1.	**PROJECT WORK:** (i) Project Proposal and Plan	10
	(ii) Execution of the Project Proposal and Plan / Collection of data, Documentation and Presentation of the report.	40
2.	Viva Voce Examination	25
	TOTAL	**75**

* CIA Marks =25 marks (Project Review 1, Project Review2 and Project Review 3)

Course Outcomes		Programme Outcomes
CO	On successful completion of this course, students will be able to	
1	show leadership skills and learn time management	PO1, PO2, PO3, PO4, PO5, PO6
2	identify various tools to be applied to a specific problem	PO1, PO2, PO3, PO4, PO5, PO6
3	evaluate the reports	PO1, PO2, PO3, PO4, PO5, PO6
4	take part in a team as well as manage it to deliver stunning outcomes	PO1, PO2, PO3, PO4, PO5, PO6
5	assess and develop the individual skills to present and organize projects	PO1, PO2, PO3, 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**	**1**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**11**

	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Internship / Industrial Training	-	-	-	-		2	25	75	100

Learning Objectives	
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience
LO3	Collaborate within and across disciplinary boundaries to solve problems
LO4	Apply mathematical and/or statistical methods to facilitate problem solving.
LO5	Exercise computational thinking over the entire software life cycle

Internship / Industrial Training:

The students to undergo 2 weeks of Internship / Industrial Training in the Industry

Sl.No	Area of Work	Maximum Marks
	a) Work Related performance – Work Attitude/ Academic preparation/ problem solving ability/ Adaptability / Overall Attendance / Progress towards learning goals	10
	b) Organizational skills – Time management skills / Planning skills/ communication skills	20
	c) Relationship with others – Willingness to cooperate with co-works/ Ability to work with supervisor / Acceptance of constructive comments / Ability to take direction	20
	Internship Report / Viva Voce Examination	25
	Total	75

* CIA Marks =25 marks (Internship Review 1, Review2 and Review 3)

Course Outcomes		Programme Outcomes
CO	On successful completion of this course , students will be able to	
1	Find their specific areas of interest , refine their skills and abilities	PO1, PO2, PO3, PO4, PO5, PO6
2	Show a greater sense of self-awareness and appreciation for others	PO1, PO2, PO3, PO4, PO5, PO6
3	Apply problem solving and critical thinking skills to solve real time problem	PO1, PO2, PO3, PO4, PO5, PO6
4	Design various solution approaches for addressing IT business needs.	PO1, PO2, PO3, PO4, PO5, PO6
5	Apply best practices of IT industries by working in the Product or service domain.	PO1, PO2, PO3, PO4, PO5, PO6

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

Guidelines for internship

- Internship should be of 2 to 3 weeks duration.
- A student is expected to find internship by himself or herself. However, the institution should assist their students in getting internship in good organizations.
- **The home institution cannot be taken as the place of internship.**
- Internship can be on any topic covered in the syllabus mentioned in the syllabus,not restricted to the specialization.
- Internship can be done, in one of the following, but not restricted to,types of organizations:
    - Software development firms
    - Hardware/ manufacturing firms
    - Any small scale industries, service providers like banks
    - Clinics/ NGOs/professional institutions like that of CA, Advocate etc
    - Civic Depts like Ward office/post office/police station/ punchayat.

Guidelines for making Internship Report

A student is expected to make a report based on the internship he or she has done in an organization. It should contain the following:

- **Certificate:** A certificate in the prescribed Performa (given in appendix 1) fromthe

organization where the internship done.

- **Evaluation form:** The form filled by the supervisor or to whom the intern was reporting, in the prescribed Performa (given in appendix 2).
- **Title:** A suitable title giving the idea about what work the student has performed during the internship.
- **Description of the organization:** A small description of 1 to 2 pages on the organization where the student has interned
- **Description about the activities done by the section where the intern has worked**: A description of 2 to 4 pages about the section or cell of the organization where the intern actually worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization.
- **Description of work allotted and actually done by the intern:** A detailed description of the work allotted and actual work performed by the intern during the internship period. Intern may give a weekly report of the work by him or her if needed. It shall be of around 7 to 10 pages.
- **Self assessment:** A self assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as interpersonal skills learned in the process. It shall be of around 2 to 3 pages.

The internship report may be around 20 to 30 pages and this needs to be submitted to the external examiner at the time of University examination.

Appendix 1

(Proforma for the certificate for internship in official letter head)

This is to certify that Mr/Ms_____ of

_____College/Institution worked as an intern as part of her B.Sc. course in Computer Science of Thiruvalluvar University. The particulars of internship are given below:

Internship starting date: _____

Internship ending date:_____

Actual number of days worked:_____

Tentative number of hours worked:_____Hours

Broad area of work:_____

A small description of work done by the intern during the period:

_____

_____

_____

_____

_____

Signature:

Name:

Designation:

Contact number:

Email:

(Seal of the organization)

Appendix 2

(Proforma for the Evaluation of the intern by the supervisor/to whom the intern was reporting in the organization)

Professional Evaluation of intern

Name of intern:_____

College/institution:_____

[Note: Give a score in the 1-5 scale by putting √ in the respective cells]

S. No	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1	Attendance					
2	Punctuality					
3	Adaptability					
4	Ability to shoulder responsibility					
5	Ability to work in a team					
6	Written and oral communication skills					
7	Problem solving skills					
8	Ability to grasp new concepts					
9	Ability to complete task					
10	Quality of work done					

Comments:

_____

_____

_____

Signature:

Name:

Designation:

Contact number:

Email:

(Seal of the organization)

SEMESTER – VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Instruction hour	Marks		
									CIA	External	Total
CC14	**Machine Learning**	**Core**	5	-	-	-	3	4	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

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

Reference Books

1.		EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2		Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

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	Credits	Marks		
								CIA	External	Total
CC15	MACHINE LEARNING LAB		-	-	5	-	3	25	75	100

LLearning 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	**75**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC16	**Data Analytics using R Programming**	Core	5	-	-	-	3	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, 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	15
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements,	15

	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	
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
Weightageof coursecontributedtoeach 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
CC17	**Data analytics using R Programming Lab**	Core	-	-	4	-	3	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 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	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	Inst. Hours	Marks		
									CIA	External	Total
EC7	**Internet of Things and its applications**	Elective	4	-	-	-	3	5	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, 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	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, 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
4.	P.Rizwan Ahmed, Internet of Things, Margham Publications, 2017

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
EC7	**Cloud Computing**	Elective	4	-	-	-	3	5	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 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	12
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 –	12

	Data Storage Approaches: RelationalApproach (SQL), Non-RelationalApproach (NoSQL).	
IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – WorkloadCharacteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.	12
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
EC7	Software Project Management	Elective	4	-	-	-	3	5	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.
3.	P.Rizwan Ahmed, Software Project Management, Margham Publications, 2017
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**
Weightageof coursecontributed toeachPSO	**13**	**11**	**10**	**13**	**13**	**12**

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
EC8	**Software Testing**	Elective	Y	-	-	-	3	5	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.	P.Rizwan Ahmed, Software Testing, Margham Publications, 2016
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
EC8	**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**: SecureSocketLayer and 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.
4.	P.Rizwan Ahmed, Cryptography, Margham Publications, 2014
	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
Weightageof coursecontributedtoeachPSO	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
EC8	**Robotics and its Applications**	Elective	4	-	-	-	3	5	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.Groover et.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
SEC8	**Open Source Software Technologies**	Skill Enha. Course(SEC)	C	-	-	-	2	2	25	75	100

Course Objective	
LO1	Able to Acquire and understand the basic concepts in Java,application of OOPS concepts.
LO2	Acquire knowledge about operators and decision-making statements.
LO3	To Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays
LO4	Understand about the applications of OOPS concepts and analyze overriding and packages through java programs.
LO5	Can Create window-based programming using applet and graphics programming.

UNIT	Details	No. of Hours	CO
I	Open Source – open source vs. commercial software – What is Linux – Free Software – Where I can use Linux - Linux kernel – Linux distributions.	6	C1
II	: Introduction Linux Essential Commands – File System concept – Standard Files –The Linux Security Model – Introduction to Unix – Unix Components Unix Files – FileAttributes and Permission – Standard I/O – Redirection – Pipes and Filters – Grep and StreamEditor	6	C2
III	Introduction - Apache Explained – Starting, Stopping and Restarting Apache –Modifying the Default configuration – Securing Apache – Set user and Group	6	C3
IV	**UNIT IV: MySQL:** Introduction to MySQL – The show databases and table – The USE command –Create Database and Tables – Describe Table – Select, Insert, Update and Delete statementdatabase.	6	C4
V	• **Introduction** –PHP Form processing – Database Access with PHP – MySQL, MySQL Functions – Inserting Records – Selecting Records – Deleting Records – Update Records.	6	C6
	Total	**30**	

Course Outcomes		**Programmeme Outcomea**
CO	On completion of this course, students will	
1	Acquire and understand the basic concepts in Java,application of OOPS concepts.	Po1
2	Acquire knowledge about operators and decision-making statements.	Po1,Po2
3	Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays	Po4,Po6
4	Understand about the applications of OOPS concepts and analyze overriding and packages through java programs.	Po4,Po5,Po6
5	Create window-based programming using applet and	Po3,Po8

	graphics programming.	
Text Book		
1	James Lee and Brent Ware “Open Source Web Development with LAMP using	
2	LINUX, Apache, MySQL, Perl and PHP”, Dorling Kindersley (India) Pvt. Ltd, 2008.	
3.	P.Rizwan Ahmed, Open Source Software, Margham Publications, 2020	
Reference Books		
1.	Eric Rosebrock, Eric Filson, “Setting up LAMP: Getting Linux, Apache, MySQL and PHP and orking together”, John Wiley and Sons, 2004.	
2.	Anthony Butcher , “Teach Yourself MySQL in 21 days”, 2nd Edition, Sams Publication.	
3.	Rich Bower, Daniel Lopez Ridreejo, Alian Liska , “Apache Administrator’s Handbook”, Sams Publication.	
4.	Tammy Fox, “RedHat Enterprise Linux 5 Administration Unleashed”, Sams Publication.	
5.	Naramore Eligabette, Gerner Jason, Wrox Press, Wiley Dreamtech Press, “Beginning PHP5,Apache, MySQL Web Development”, 2005.	
Web Resources		
1.	Introduction to Open-Source and its benefits - GeeksforGeeks	
2.	https://www.bing.com/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**1**	**3**	**2**	**2**	**1**	**1**
CO 2	**3**	**1**	**3**	**2**	**3**	**3**
CO 3	**3**	**2**	**2**	**-**	**2**	**1**
CO 4	**2**	**-**	**3**	**3**	**3**	**1**
CO 5	**3**	**3**	**3**	**3**	**3**	**2**
WEIGHTAGE OF COURSE CONTRIBUTED TO EACH PSO	**12**	**9**	**13**	**10**	**12**	**8**

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