H.H. THE RAJAH'S COLLEGE

(AUTONOMOUIS)

PUDUKKOTAI – 622 001.

PG AND RESEARCH DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS

B.Sc. COMPUTER SCIENCE

2023-2024 ONWARDS

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.

1. 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.

1. 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

2. 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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

2. 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.

3. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher Education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world.	• Instil confidence among students • Create interest for the subject
I, II, III AND 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 • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical know how of solving real life problems using ICT tools

III, IV, V AND VI	Elective papers- An open choice of topics categorizedunder 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	**Project with Viva – voce**	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI	**Introduction of Professional Competency component**	• Curriculum design accommodates all category of learners; 'Mathematics for Advanced Explain' component will comprise of advanced topics in Mathematics and allied fields, for those in the peergroup / 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	5	2.3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC - XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva- voce CC -XII	4	5	6.4 Elective - VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific **(Allied I) Paper I**	3	4	2.5 Elective II Generic/ Discipline Specific **(Allied I) Paper2I**	3	4	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 Soft Skill – I (Common Paper)	2	2	2.6 Skill Enhancement Course SEC-2 Soft Skill – II (Common Paper)	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 **Naan Mudhalvan (NMC 1)**	2	2	3.7 Skill Enhancement Course SEC-5 **Naan Mudhalvan (NMC 1)**	2	2	4.7 Skill Enhancement Course SEC-7 **Naan Mudhalvan (NMC 1)**	2	2	5.7 Value Education **Naan Mudhalvan (NMC 1)**	2	2	6.7 Professional Competency Skill **Naan Mudhalvan (NMC 1)**	2	2
						3.8 E.V.S.	2	2				5.8 Summer Internship /Industrial Training	2				
	23	**30**		**23**	**30**		**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

Semester-I

Part		List of Courses	Credit	Hours per week (L/T/P)
I	23ULT1/23ULH1	Part – I – Tamil Paper-I / Hindi Paper-I	3	6
II	23ULE1	Part – II English Paper-I	3	6
III	23UCS1	CC1 - Python Programming	5	5
	23UCS2P	CC2 - Python Programming Practical	5	5
	23UCMGE1	Generic Elective Course 1 – Allied Maths Paper - I	3	4
IV	23UCSSEF1	Skill Enhancement Course - Foundation Course - Problem Solving Techniques	2	2
	23USE1	Skill Enhancement Course SEC 1 – – Soft Skill and Industry Awareness Paper - I	2	2
			23	30

Semester-II

Part		List of Courses	Credit	Hours per week (L/T/P)
I	23ULT2/ 23ULH2	Part – I – Tamil Paper-II / Hindi Paper-II	3	6
II	23ULE2	Part – II English Paper-II	3	6
III	23UCS3	CC3 - Data Structure and Algorithms	5	6
	23UCS4P	CC4 - Data Structure and Algorithms Practical	5	5
	23UCMGE2	Generic Elective Course 2– Allied Maths Paper - II	3	5
IV	23USE2	Skill Enhancement Course SEC 2 – Soft Skill and Industry Awareness Paper - II	2	2
	23UCSNMC1	Skill Enhancement Course SEC 3 – NMC - I	2	-
			23	30

Semester-III

Part		List of Courses	Credit	Hours per week (L/T/P)
I	23ULT3/ 23ULH3	Part – I – Tamil Paper-III / Hindi Paper-III	3	6
II	23ULE3	Part – II English Paper-III	3	6
III	23UCS5	CC5- Java Programming	5	5
	23UCS6P	CC6 - Java Programming Practical	5	5
		Generic Elective Course 3 – Allied Physics Paper	-	3
		Generic Elective Course 3 – Allied Physics Practical	-	3
IV	23USE3	Skill Enhancement Course SEC 4 – (Entrepreneurial Skill) (Common Paper)	1	1
	23UCSNMC2	Skill Enhancement Course SEC 5 – (Naan Muthalvan) NMC-II	2	-
	23UES	Environmental Studies	-	1
			19	30

Semester-IV

Part		List of Courses	Credit	Hours per week (L/T/P)
I	23ULT4/H4	Part – I – Tamil Paper-IV / Hindi Paper-IV	3	6
II	23ULE4	Part – II English Paper-IV	3	6
III	23UCS7	CC7 - Database Management System	5	5
	23UCS8P	CC8 - Database Management System Practical	5	5
	23UCPGE3	Generic Elective Course 3 – Allied Physics Paper	3	2
	23UCPGE4P	Generic Elective Course 3 – Allied Physics Practical	3	3
IV	23UCSNMC3	Skill Enhancement Course SEC 6 – (Nan Muthalvan) NMC-III	2	-
	23UVEGS	Value Education & Gender Studies	2	2
	23UES	Environmental Studies	2	1
			28	30

Semester-V

Part		List of Courses	Credit	Hours per week (L/T/P)
III	**23UCS9**	**CC9 - Software Engineering**	**4**	**5**
	23UCS10	**CC10 – Operating Systems**	**4**	**5**
	23UCS11P	**CC11 - Linux Practical**	**4**	**5**
	23UCS12PW	**Project with Viva Voce**	**4**	**5**
	23UCSE1A	Discipline Specific Elective - **IOT and its Applications**	**3**	**4**
	23UCSE1B	Discipline Specific Elective – Robotics and its Applications		
	23UCSE2A	Elective Course–EC6(Discipline Specific)– **Computer Hardware (OMR based objective paper)**	**3**	**4**
	23UCSE2B	Elective Course–EC6(Discipline Specific)– Management Information System (OMR based objective paper)		
IV	**23UCSNMC4**	**Skill Enhancement Course SEC 7 – (Nan Muthalvan) NMC-IV**	**2**	**2**
	23UIT	**Summer Internship / Industrial Training**	**2**	**-**
			26	**30**

Semester-VI

Part		List of Courses	Credit	Hours per week (L/T/P)
III	**23UCS13**	**CC13 - Computer Networks**	**4**	**6**
	23UCS14	**CC14 - Mobile Application Development**	**4**	**6**
	23UCS15P	**CC15 - Mobile Application Development Practical**	**4**	**6**
	23UCSE3A	**Discipline Specific Elective – Cryptography**	**3**	**5**
	23UCSE3B	Discipline Specific Elective – Human Computer Interaction		
	23UCSE4A	**Discipline Specific Elective - Data Mining and Warehousing**	**3**	**5**
	23UCSE4B	Discipline Specific Elective – Artificial Intelligence		
IV	**23UCSNMC5**	**Skill Enhancement / Professional Competency Skill - (Nan Muthalvan) NMC-V**	**2**	**2**
	23UEA	**Extension Activity**	**1**	**-**
			21	**30**

Annexure I

Suggested topics in Core component

1. Programming in C
2. Programming in C Lab
3. Object oriented Programming using C++
4. Object oriented Programming using C++ Lab
5. Mobile Application Development
6. Mobile Application Development Lab
7. Data Analytics using R
8. Data Analytics using RLab
9. Machine Learning
10. Machine Learning Lab
11. Data Mining and Warehousing
12. Software Metrics
13. Network Security

Suggested topics in Elective Course

Generic Specific

1. Discrete Mathematics – I
2. Discrete Mathematics-II
3. Statistical Methods and its Application-I
4. Statistical Methods and its Application-II
5. Digital Logic Fundamentals
6. Numerical Methods
7. Optimization Techniques
8. Nano Technology
9. Introduction to Linear Algebra
10. Graph Theory and its Application
11. Resource Management Techniques and more

Elective course – (EC1- EC8)-Discipline Specific

1. Natural Language Processing
2. Analytics for Service Industry
3. Cryptography
4. RDBMS with PL/SQL
5. Big Data Analytics
6. IOT and its Applications
7. Software Project Management
8. Image Processing
9. Human Computer Interaction

10. Fuzzy Logic
11. Artificial Intelligence
12. Robotics and its Applications
13. Computational Intelligence
14. Cloud Computing
15. Artificial Neural Network
16. Introduction to Data Science
17. Agile Project Management
18. Virtual Reality and more

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

Annexure II

Suggested topics in Skill Enhancement (SEC1-SEC8) Course

Skill Enhancement Course

1. Fundamentals of Information Technology
2. Introduction to HTML
3. Web Designing
4. PHP Programming
5. Software Testing
6. Understanding Internet
7. Office Automation
8. Quantitative Aptitude
9. Multimedia Systems
10. Advanced Excel
11. Biometrics
12. Cyber Forensics
13. Pattern Recognition
14. Enterprise Resource Planning
15. Simulation and Modelling
16. Organization Behavior and more

I SEMESTER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS1	Python programming	Core	5	-	-	-	5	25	75	100

Learning Objectives	
LO1	To make students understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO3	To impart knowledge on demand and supply concepts
LO4	To make the students learn best practices in PYTHON programming
LO5	To know the costs and profit maximization

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 strings in various application, Significance of Modules, Work with functions, Strings and modules.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with List, tuples and dictionary, Write program using list, tuples and dictionary.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	ReemaThareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.	
2	Dr. R. NageswaraRao, "Core Python Programming", First Edition, 2017, Dream tech Publishers.	
Reference Books		
1.	VamsiKurama, "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
23UCS2P	Python Programming Practical	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 Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. 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	Credits	Marks		
								CIA	External	Total
23UCSSEF1	Problem Solving Techniques	FC	2	-	-	-	2	25	75	100

Learning Objectives	
LO1	Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.
LO2	Implement different programming constructs and decomposition of problems into functions.
LO3	Use data flow diagram, Pseudo code to implement solutions.
LO4	Define and use of arrays with simple applications
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	**Introduction:** History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. **Programming Languages:** Machine language, Assembly language, High-level language,4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.	6
II	**Data:** Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC).**Structured Programming: Algorithm:** Features of good algorithm, Benefits and drawbacks of algorithm. **Flowcharts:** Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts. **Pseudocode:** Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. **Program design:** Modular Programming.	6
III	**Selection Structures:** Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. **Repetition Structures:** Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.	6
IV	**Data:** Numeric Data and Character Based Data. **Arrays:** One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.	6
V	**Data Flow Diagrams:** Definition, DFD symbols and types of DFDs. **Program Modules:** Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. **Files:** File Basics-Creating and reading a sequential file- Modifying Sequential Files.	6
TOTAL HOURS		**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Study the basic knowledge of Computers. Analyze the programming languages.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Study the data types and arithmetic operations. Know about the algorithms. Develop program using flow chart and pseudocode.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Determine the various operators. Explain about the structures. Illustrate the concept of Loops	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Study about Numeric data and character-based data. Analyze about Arrays.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Explain about DFD Illustrate program modules. Creating and reading Files	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	**Stewart Venit,** "Introduction to Programming: Concepts and Design", Fourth Edition, 2010, Dream Tech Publishers.	
Web Resources		
1.	https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm	
2.	http://www.nptel.iitm.ac.in/video.php?subjectId=106102067	
3.	http://utubersity.com/?page_id=876	

Mapping with Programme Outcomes:

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

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

II SEMESTER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS3	Data Structure and Algorithms	Core	5	-	-	-	5	25	75	100

Learning Objectives		
LO1	To understand the concepts of ADTs	
LO2	To learn linear data structures-lists, stacks, queues	
LO3	To learn Tree structures and application of trees	
LO4	To learn graph strutures and and application of graphs	
LO5	To understand various sorting and searching	
UNIT	**Contents**	**No. of Hours**
I	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementationsingly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal	15
II	Stack ADT-Operations- Applications- Evaluating arithmetic expressions – Conversion of infix topostfix expression-Queue ADT-Operations-Circular Queue- Priority Queue- deQueueapplications of queues.	15
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees- B-Tree- B+ Tree – Heap-Applications of heap.	15
IV	Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs.	15
V	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining- Open Addressing-RehashingExtendible Hashing	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO6
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO2
CO3	Describe the hash function and concepts of collision and its resolution methods	PO2,PO4
CO4	Solve problem involving graphs, trees and heaps	PO4,PO6
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO5,PO6
Text Book		
1	1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.	
2	ReemaThareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition	
Reference Books		
1.	Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition.	
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003	
Web Resources		
1.	https://www.programiz.com/dsa	
2.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/	

Mapping with Programme Outcomes:

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

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS4P	**Data Structure and Algorithms Practical** [Note: Practicals may be offered through C / C++ / Python]	**Core**	**-**	**-**	**5**	**-**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph strutures and and application of graphs
LO5	To understand various sorting and searching

Sl. No.	**Contents**	**No. of Hours**
1.	Write a program to implement the List ADT using arrays and linked lists.	**60**
2.	Write a programs to implement the following using a singly linked list. • Stack ADT • Queue ADT	
3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).	
4.	Write a program to implement priority queue ADT.	
5.	Write a program to perform the following operations: • Insert an element into a binary search tree. • Delete an element from a binary search tree. • Search for a key element in a binary search tree.	
6.	Write a program to perform the following operations • Insertion into an AVL-tree • Deletion from an AVL-tree	
7.	Write a programs for the implementation of BFS and DFS for a given graph.	
8	Write a programs for implementing the following searching methods: • Linear search • Binary search.	

9.	Write a programs for implementing the following sorting methods: • Bubble sort • Selection sort • Insertion sort • Radix sort.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO4,PO5
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1, PO4,PO6
CO3	Describe the hash function and concepts of collision and its resolution methods	PO1,PO3,PO6
CO4	Solve problem involving graphs, trees and heaps	PO3,PO4
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1,PO5,PO6

Text Book	
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.
2	ReemaThareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition
Reference Books	
1	Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003
Web Resources	
1.	https://www.programiz.com/dsa
2.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

Mapping with Programme Outcomes:

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

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

III SEMESTER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS5	**Java Programming**	**Core**	**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 Java from the basics up.	
LO3	To enable the students to use classes, objects and methods.	
LO4	To provide fundamental knowledge of inheritance, interface and packages.	
LO5	To enable the students to use AWT controls for GUI.	
UNIT	**Contents**	**No. of Hours**
I	**Fundamentals of Object-Oriented Programming:** Introduction – Object Oriented Paradigm – Basic Concepts of OOP – Benefits of OOP – Applications of OOP. Java Evolution Java History – Java Features – Comments – Java Program Structure – Tokens – Java Statements – JVM – Command Line Arguments. Constants – Variables – Data Types – Type Casting.	15
II	**Operators and Expressions:** Arithmetic Operators – Arithmetic expressions, Evaluation of expression – Type Conversions – Operator Precedence – Mathematical Functions. Decision Making and Branching If – if…..else – Nesting of if……. Else – else if – switch - ?: operator. Decision Making and Looping, While – do while – for loops – jump in loops – labelled loops.	15
III	**Classes, Objects and Methods:** Defining a class – Adding variables, methods – Creating objects – Accessing Class Members. **Constructors** – Methods overloading – static members – Nesting of Methods. – **Inheritance** – Overriding methods – Abstract methods and classes – visibility control. **Arrays and Strings:** Arrays – One Dimensional Arrays – Creating an array – Two Dimensional Arrays – Strings.	15
IV	**Interfaces and Packages:** Multiple Inheritance - Defining interfaces – Extending interfaces – implementing interfaces – Accessing interface variables. Packages: Java API Packages – Using system packages – Naming conventions – Creating Packages – Accessing a Package – Using a Package – Adding a Class to a Package.	15
V	**AWT Controls:** The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box	15

	- Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.	
	Total	**75**
Course Outcomes		**Programmem Outcome**
CO	On completion of this course, students will;	
CO1	Understand the basic Object-oriented concepts. Implement the basic constructs of Java.	PO1, PO2, PO6
CO2	Implement the basic controls of Java.	PO2, PO3, PO8
CO3	Implement arrays, strings and inheritance of Java	PO1, PO3, PO5
CO4	Implement packages and interfaces.	PO2, PO6
CO5	Use AWT to create GUI.	PO1, PO3, PO6
Text Books:		
1.	**"Programming with JAVA"**, Second Edition 2006", E. Balagurusamy, TATA McGraw-Hill Publishing Company Limited, New Delhi.	
References :		
1.	"Java 2 – The Complete Reference", Fifth Edition, 2006 Herbert Schildt, TATA Mc Graw Hill Publishing Company Limited, New Delhi.	
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010	
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	Marks		
								CIA	External	Total
23UCS6P	**Java Programming Practical**	**Core**	**-**	**-**	**5**	**-**	**5**	**40**	**60**	**100**

Course Objectives:	
LO1	Understand the basic concepts of Java Programming with emphasis on ethics and principles of professional coding
LO2	Demonstrate the branching and looping, creation of objects, classes and methods.
LO3	Demonstrate the creation of objects, classes and methods and the concepts of constructor, methods overloading, Arrays, Strings
LO4	Develop applications using Interfaces and Packages
LO5	Design a page using AWT controls and Mouse Events in Javaprogramming Implement the concepts of code reusability and debugging.

Excercise	**Details**	
1	Classes and Objects	60
2	Control Statements	
3	Constructors	
4	Method Overloading and Overriding	
5	String Handling	
6	Inheritance	
7	Packages	
8	Interfaces	
9	AWT controls	
10	AWT Event Handling	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understand the basic Object-oriented concepts. Implement the basic constructs of Java.	PO1
CO2	Implement classes and objects	PO1, PO2
CO3	Implement Method Overloading, Overriding and inheritance of Java	PO4, PO6
CO4	Implement packages and interfaces	PO4, PO5, PO6
CO5	Implement AWT and Event handling.	PO3, PO6

Text Book	
1	**"Programming with JAVA"**, Second Edition 2006", E. Balagurusamy, TATA McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books	
1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
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:

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

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

IV SEMESTER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS7	**Database Management System**	**Core**	**5**	**-**	**-**	**-**	**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**	15

	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.	
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

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	Marks		
								CIA	External	Total
23UCS8P	**Database Management System Practical**	**Core**	**-**	**-**	**5**	**-**	**4**	**40**	**60**	**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**
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	60
Total	**60**

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

V SEMESTER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS9	**Software Engineering**	**Core**	**5**	**-**	**-**	**-**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Gain basic knowledge of analysis and design of systems
LO2	Ability to apply software engineering principles and techniques
LO3	Model a reliable and cost-effective software system
LO4	Ability to design an effective model of the system
LO5	Perform Testing at various levels and produce an efficient system.

UNIT	Contents	No. of Hours
I	**Introduction to Software Engineering:** Some Definitions – Some Size factors – Quality and Productivity Factors – Managerial Issues. Planning a Software Project: Defining the Problem – Developing a Solution Strategy – Planning the Development Process – Planning an Organizational Structure – Other Planning Activities.	15
II	**Software Cost Estimation:** Software Cost Factors – Software Cost Estimation Techniques – Staffing-Level Estimation – Estimating Software Maintenance Costs.	15
III	**Software Requirements Definitions:** The Software Requirements Specification – Formal Specification Techniques – Languages and Processors for Requirements Specification.	15
IV	**Software Design:** Fundamental Design Concepts – Modules and Modularization Criteria – Design Notations – Design Techniques – Detailed Design Considerations – Real-Time and Distributed System Design – Test Plans – Milestones, Walkthroughs, and Inspections - Design Guidelines.	15
V	**Verification and Validation Techniques:** Quality Assurance – Static Analysis – Symbolic Execution – Unit Testing and Debugging – System Testing – Formal Verification. **Software Maintenance:** Enhancing Maintainability During Development – Managerial Aspects of Software Maintenance – Configuration Management – Source-Code Metrics – Other Maintenance Tools and Techniques.	15
	Total	**75**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Gain basic knowledge of analysis and design of systems	PO1
CO2	Ability to apply software engineering principles and techniques	PO1, PO2
CO3	Model a reliable and cost-effective software system	PO4, PO6
CO4	Ability to design an effective model of the system	PO4, PO5, PO6
CO5	Perform Testing at various levels and produce an efficient system.	PO3, PO6
Text Books		
1.	Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997.	
References Books		
1.	Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018	
2.	Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill.	
3.	James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions.	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**3**	**2**	**2**	**3**
CO2	**3**	**2**	**2**	**2**	**1**	**2**
CO3	**3**	**3**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**2**
Weightage of course contribute d to each PO/PSO	**15**	**13**	**14**	**10**	**10**	**11**

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS10	**Operating Systems**	**Core**	**5**	**-**	**-**	**-**	**4**	**25**	**75**	**100**

Learning Objective	
LO1	Understanding the design of the Operating System
LO2	Imparting knowledge on CPU scheduling, Processand 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 the concept of Linux and Shell programming

UNIT	**Details**	**No. of Hours**
I	**INTRODUCTION:** What is an Operating System? Mainframe Systems Desktop Systems Multiprocessor Systems Distributed Systems Clustered Systems - Real-Time Systems Handheld Systems Feature Migration Computing Environments. **COMPUTER-SYSTEM STRUCTURES:** Computer-System Operation I/O Structure Storage Structure Storage Hierarchy Hardware Protection Network Structure. **OPERATING-SYSTEM STRUCTURES:** System Components Operating-System Services System Calls System Programs System Structure Virtual Machines.	15
II	**PROCESSES:** Process Concept Process Scheduling Operation on Processes Cooperating Processes Interprocess Communication. **THREADS:** Overview Multithreading Models - Threading Issues. **CPU SCHEDULING:** Basic Concepts Scheduling Criteria Scheduling Algorithms MultipleProcessor Scheduling Real-Time Scheduling Algorithm Evaluation.	15
III	**PROCESS SYNCHRONIZATION:** Background - The Critical-Section Problem Synchronization Hardware Semaphores Classic Problems of Synchronization. **DEADLOCKS:** System Model Deadlock Characterization Methods for Handling Deadlocks from Deadlock.	15
IV	**MEMORY MANAGEMENT:** Background Swapping Contiguous Memory Allocation Paging - Segmentation with Paging. **VIRTUAL MEMORY:** Background - Demand Paging Process Creation - Page Replacement Allocation of Frames Thrashing Other Considerations.	15
V	**FILE-SYSTEM INTERFACE:** File Concept Access Methods Directory Structure File System Mounting File Sharing Protection. **FILE-SYSTEM IMPLEMENTATION:** File-System Structure File System Implementation - Directory Implementation Allocation Methods Free-Space Management Efficiency and Performance Recovery.	15
	Total	**75**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Define the fundamentals of OS and identify the concepts relevant to process, process life cycle, Scheduling Algorithms, Deadlock and Memory management.	PO1
CO2	Know the critical analysis of process involving various algorithms, an exposure to threads and semaphores.	PO1, PO2
CO3	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
CO4	Have complete knowledge of Scheduling Algorithms and its types.	PO4, PO5, PO6
CO5	Understand memory organization and management	PO3, PO8
Text Book		
1	A. Silberschatz, and P.B. Galvin.Operating Systems Concepts, Nineth Edition, JohnWiley & Sons (ASIA) PteLtd.,2012	
Reference Books		
1.	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall ofI ndia,2012.	
2.	H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia,2011	
Web Resources		
1.	https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf	
2.		

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**-**	**1**	**2**	**-**	**1**
CO2	**2**	**3**	**1**	**2**	**-**	**1**
CO3	**3**	**2**	**-**	**3**	**-**	**1**
CO4	**1**	**3**	**1**	**1**	**3**	**2**
CO5	**3**	**-**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	12	8	4	11	5	6

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS11P	**Linux Practical**	**Core**	**-**	**-**	**5**	**-**	**4**	**40**	**60**	**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**
Write Shell Programs for the following in Linux Operating System 1. Check whether the given number is prime or not. 2. Find the biggest of given two numbers 3. To check whether the given number is odd or even 4. To generate Fibonacci Series 5. To prepare electric bill for domestic consumers. For first 100 units - Rs.0.75/ unit For next 100 units - Rs.1.50/unit Above 200 units - Rs.3.00/unit. Prepare the bill in the following format: Customer No. -------- Customer Name ---------- Pre. Reading ---------- Cur. Reading---------- Units Consumed ---------- Charge ---------- Signature 6. Write a program to display the result PASS or FAIL using the information given below: Student Name, Student Reg. No. Mark1, Mark2, Mark3, Mark4. The minimum pass for each subject is 50. 7. Write a program to prepare a Payroll with Basic Pay, DA, Allowances, PF, Gross Pay and Net Pay. 8. Using Case Statement, write a program to check the files ending with vowels. 9. Write a program to sort the names in alphabetical order, numbers in ascending and descending order. 10. Write a menu driven program to print Bio-data for five persons	60
Total	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Explain the basic operations in LINUX	PO1
CO2	Utilize the files and directories for manipulation	PO1, PO2
CO3	Plan how to use granting and revoking permission in LINUX.	PO4, PO6
CO4	Determine the performance of LINUX using various commands.	PO4, PO5, PO6
CO5	Develop scripts to use effectively in LINUX system	PO3, PO4
Web Resources		
1.	Web resources from NDL Library, E-content from open-source libraries	

Mapping with Programme Outcomes:

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
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 contributed to 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	Marks		
								CIA	External	Total
23UCSE1A	**IOT and its applications**	**Elective**	**4**	**-**	**-**	**-**	**3**	**25**	**75**	**100**

Learning Objective	
LO1	Use of Devices, Gateways and Data Management in IoT.
LO2	Design IoT applications in different domain and be able to analyze their performance
LO3	Implement basic IoT applications on embedded platform
LO4	To gain knowledge on Industry Internet of Things
LO5	To Learn about the privacy and Security issues in IoT

UNIT	Details	No. of Hours
I	**IOT and Web Technology:** The Internet of Things Today : Definition and Brief History of IoT-Characteristics of IoT-Components and working principles of IoT-Advantages and Disadvantages of IoT –The IoT vision – IoT Applications: IoT Applications used in various fields- Future Internet Technologies-IoT and its Technologies-Cloud Computing Technologies-Infrastructure-Networks and Communications: IoT Communication Protocols – IoT Communication Protocol Layers.	15
II	**M2M to IoT:** M2M to IoT A Basic Perspective: M2M Concepts- Key Application Areas of M2M-Benefits and Drawbacks of M2M- M2M and IoT-M2M and IoT key Differences-IoT value chain-An Emerging industrial structure for IoT-Industrial IoT Trends and applications-Challenges in Industrial IoT solutions-Use cases for Industrial to IoT-M2M to IoT- An Architectural overview: Building Architecture - An IoT Architecture Outline.	15
III	**IoT Architecture:** State of the Art-IoT Architecture: IoT Architecture Building Blocks-Stages of IoT Architecture-IoT Architecture-Functional Layers-IoT Architecture standards-IoT Architectural Reference Model: Domain Model (DM)-Information Model (IM)-Functional Model- Communication Model – IoT Security Model – Benefits of Architectural Reference Models (ARM).	15
IV	**IoT Applications for Value Creations:** IoT Applications-Introduction: Value Creation using IoT Applications- Features of Value Creation using IoT-Challenges Faced by IoT Industry Applications- IoT Applications for Industry : Future Factory : IoT in the Enterprise- IoT in Present Industries Value Creations-IoT in the Future Industries Trends- Smart Objects and Smart Applications : Smartphone and Tablets –Smart TVs - IoT for Retailing Industry: How Can we Apply IoT to Retail-An Example Use Case of the Power of IoT in Retail Establishments-Home Management-How it Works-Key Benefits of Smart Home Management.	15
V	**IoT Privacy, Security and Governance:** IoT Privacy, Security and Governance-an Introduction- Overview of Governance, Privacy and Security Issues: IoT Devices Privacy- IoT Security- IoT Governance- Security, Privacy, and Trust in IoT- Data-Platforms for Smart Cities: Concerns of Privacy and Security in Smart Cities -Security Requirements of Smart Cities – Security Issues and Challenges of Smart Cities – First Steps Towards a Secure Platform : Five IoT Security Steps.	15
	Total	**75**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Work with big data tools and its analysis techniques.	PO1
CO2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
CO3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
CO4	Perform analytics on data streams.	PO4, PO5, PO6
CO5	Learn NoSQL databases and management.	PO3, PO5
Text Book		
1	Dr. Mahalingam Palaniandi, "IOT AND ITS APPLICATIONS", VR1 Publication, 2024	
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", A press Publications 2013, 1st Edition,.	
3	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011	
Web Resources		
1.	https://www.simplilearn.com	
2.	https://www.javatpoint.com	
3.	https://www.w3schools.com	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**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	Marks		
								CIA	External	Total
23USCE1B	**Robotics and its Applications**	**Elective**	**4**	**-**	**-**	**-**	**3**	**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**
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.	15
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	15
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	15
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	15
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.	15
	Total	**75**

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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**15**	**10**

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

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UCSE2A	Computer Hardware	ELECTIVE	Y	-	-	-	4	3	25	75	100

Course Objective		
LO1	To gain knowledge Motherboard be able to analyze their performance	
LO2	To gain knowledge on Mouse,KeyBoard,Printers	
LO3	To Learn about the Computer Network	
LO4	To Learn about the System Diagnostic Tools	
LO5	To Learn about the Number Systems.	
UNIT	**Details**	**No. of Hours**
I	**Introduction to Computers**– Types of Computers - Micro, Mini, Mainframe and Super Computer, Architecture of a Computer System– Processor (CPU) - Types and their specifications (Intel: Celeron, P4 family, Xeon, dual core, quad core, core 2 duo, i3,i5,i7 and AMD), ALU, Memory - Types, Storage, Semiconductor memories: RAM, ROM, PROM, EMPROM, EEPROM, Static and Dynamic, Cache Memory,Secondary Storage Devices -Types, Capacity, Popular Brands, Standards, Interface, Concept of Tracks, Sector, Cylinder and Cluster.Jumper setting, CMOS setting,	6
II	**Mouse, KeyBoard, Printers** - Study of Basic Principle, Construction and Operation of wired and wireless Optical Mouse, wired and wireless Keyboard, Study of Printers types, principle, Construction, Operation and Application of Impact Printers–Dot Matrix and Line Printers, Non Impact Printers - Inkjet, Laser and Multi-Function Printers.	6
III	(**Introduction to Computer Networks** – Definition, Advantages, Architecture: Peer-to-Peer and Client/Server Network. Network Topologies – Star, Ring, Bus, Tree, Mesh, Hybrid.Types of Network – Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Intranet and Internet. Wi-Fi, Bluetooth. **Network Components** – Modems, Firewall, Hubs, Bridges, Routers, Gateways, Repeaters, Transceivers, Switches – their functions, advantages and applications.	6
IV	**System Diagnostic Tools** - Diagnostic Tools Definition, Application of Windows OS Diagnostic Tools for Task Scheduler, Event Viewer, Shared Folder, Disk Management Services, Memory Diagnostic, Windows Defender, Windows OS Diagnostic Command for Resource, Performance and Memory – perfmon, perfmon /report and mdsched,	6

	Linux OS Diagnostic Command – htop, vmstat, iotop ,lscpu, hwinfo, lspci, lsscsi, lsusb, lsblk, fdisk and free.	
V	**Number Systems:** Decimal - Binary - Octal – Hexadecimal - Conversion From One Another - Binary Addition - Subtraction - Multiplication And Division – Codes - BCD Weighted-Excess – Gray - Error Detection Codes.	6
	Total	**30**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Would have learnt the basics of Hardware	PO1
2	Would have learnt the various Hardware Components	PO1, PO2
3	Learn about Operation and Application of Network Hardware Devices	PO4, PO6
4	Learn about System Diagnostic Tools	PO4, PO5, PO6
5	Learn about Number Systems	PO3, PO8
Text Book		
1	Shelly, Cashman, Vermaat "Introduction to Computers"	
Reference Books		
1.	Dr. M.R. Khan, Nitesh Kumar Sharma, Preesat Biswas "Fundamental of Computers with Hardware and Software"	
2.	PCHardware:TheCompleteReferencebyCraigZacker andJohn Rourke	
3.	PCHardware:ABeginner'sGuidebyRonGilster	
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**
CO 1	**3**	**2**	**-**	**2**	**2**	**2**
CO 2	**2**	**2**	**2**	**2**	**-**	**3**
CO 3	**1**	**3**	**-**	**2**	**3**	**2**
CO 4	**1**	**3**	**1**	**2**	**2**	**2**
CO 5	**1**	**2**	**3**	**3**	**2**	**2**
Weightage	8	12	6	13	9	11
Weightage of course contributed to each PSO	1.6	2.4	1.2	2.6	1.8	2.2

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

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23UCSE2B	MANAGEMENT INFORMATION SYSTEMS	ELECTIVE	Y	-	-	-	4	3	25	75	100

Course Objective	
LO1	To learn the fundamentals of MIS.
LO2	To visualize the various Management Techniques.
LO3	To Learn about the Data Resource Management.
LO4	To Understand the Telecommunication Networks.
LO5	To gain knowledge on Data Resource Management.

UNIT	Details	No. of Hours
I	**Foundations of Information Systems in Business:** Foundation Concepts – Components of Information Systems	6
II	**Competing with Information Technology:** Fundamentals of Strategic Advantage – Using Information Technology for Strategic Advantage	6
III	**Data Resource Management:** Technical Foundations of Database Management – Managing Data Resources.	6
IV	**Telecommunications and Networks:** The Networked Enterprise – Telecommunications Network Alternatives	6
V	**Decision Support Systems:** Decision Support in Business – Artificial Intelligence Technology in Business – Developing Business / IT Solutions	6
	Total	**30**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Would have learnt the basics of Management Information System	PO1
2	Would have learnt the fundamentals of Strategic Advantage	PO1, PO2
3	Learn about Managing Data Resources	PO4, PO6
4	Learn about Telecommunications Network Alternatives	PO4, PO5, PO6
5	Learn about Artificial Intelligence Technology in Business	PO3, PO8
Text Book		
1	James A. O'brien, Fourth Edition, "Management Information Systems",	
Reference Books		
1.	Gordon B. Davis Margrethe H. Olson , "Management Information Systems"	
Web Resources		
1.	https://www.tutorialspoint.com/management_information_system/index.htm	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	**2**	**2**	**2**	**2**	**3**	**2**
CO 2	**2**	**1**	**3**	**2**	**-**	**2**
CO 3	**3**	**3**	**1**	**1**	**1**	**2**
CO 4	**2**	**3**	**3**	**1**	**-**	**1**
CO 5	**3**	**2**	**3**	**1**	**1**	**-**
Weightage of course contributed to each PSO	12	11	12	7	5	7

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS12PW	**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 Review 2 and Project Review 3)**

Course Outcomes		**Programme Outcomes**
CO	On successful completion of this course, students will be able to	
CO1	Show leadership skills and learn time management	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Identify various tools to be applied to a specific problem	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Evaluate the reports	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Take part in a team as well as manage it to deliver stunning Outcomes	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Assess and develop the individual skills to present and Organize projects	PO1, PO2, PO3, PO4, PO5, PO6

Mapping with Programme Outcomes:

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
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	Marks		
								CIA	External	Total
23UIT	**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
1	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
2	Internship Report / Viva Voce Examination	25
Total		75

*** CIA Marks =25 marks (Internship Review 1, Review 2 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:

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
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

S-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) from the 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 H.H. The Rajah's College, Pudukkottai. 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)

VI SEMESTER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS13	**Computer Networks**	**Core**	**6**	**-**	**-**	**-**	**4**	**25**	**75**	**100**
Learning 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, Application layer									
UNIT	**Details**									**No. of Hours**
I	**Introduction**: Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs.									15
II	**Physical Layer:** Theoretical Basis for Data Communication - Guided Transmission Media. Wireless Transmission - Communication Satellites.									15
III	**Data Link Layer**: Design Issues – Error Detection and Correction 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:** The transport services – Elements of Transport Protocol – Internet Transporet Protocols, UDP and TCP. **Application Layer:** DNS, FTP, HTTP, SMTP, Eletronic mail, WWW.									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 Congestion control									PO4, PO5,

	algorithms	PO6
CO5	To understand various protocols such as FTP, HTTP, Telnet, DNS	PO3, PO4
Text Book		
1	A. S. Tanenbaum, "Computer Networks", 6th Edition, Prentice-Hall of India, 2021.	
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	Marks		
								CIA	External	Total
23UCS14	Mobile Application Development	Core	6	-	-	-	4	25	75	100

Learning Objective	
LO1	To provide the students with the basics of Android Programming
LO2	To gain knowledge on Software Development tools for Mobile Applications
LO3	To understand various Media and Canvas tools
LO4	Understand the concepts of Maps and Social media
LO5	To gain Knowledge about Database

UNIT	Details	No. of Hours
I	Introduction to Android Operating System – Configuration of Android Environment- Create the First Android Application. Layout: Vertical, Vertical Scroll, horizontal, horizontal Scroll, Table Layout arrangement. **Designing User Interface:** Label Text - TextView – Password Text Box - Button – ImageButton – CheckBox – Image - RadioButton – Slider – Autocomplete text View.	15
II	User Interface: Spinner–Switch – Side Bar-ListView - List Picker -Image Picker - Notifier-Time andDatePicker - Web Viewer.	15
III	Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player – Canvas.	15
IV	Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Email Picker – Phone Number Picker – Phone Call - Social: Texting.	15
V	Storage: Cloud DB – Tiny DB – Experimental – Fire DB.- What is NoSQL? – Types of NoSQL-CAP Theorem – Advantages and Disadvantages of NoSQL	15
TOTAL		75

CO	Course Outcomes
CO1	To provide the students with the basics of Android Programming
CO2	To gain knowledge on Software Development tools for Mobile Applications
CO3	Knowledge about Media and Canvas

CO4	Knowledge about Maps and social components
CO5	To gain Knowledge about Database
Textbooks	
1	Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books Limited.
Reference Books	
1	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.
2	Deital, Android for Programmers-An App-Driven Approach, Second Edition.
	NOTE: Latest Edition of Textbooks May be Used
Web Resources	
	http://ai2.appinventor.mit.edu/reference/
	http://appinventor.mit.edu/explore/paint-pot-extended-camera

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
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**
Weightage of course contributed to each PSO	**14**	**13**	**14**	**14**	**14**	**13**

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCS15P	Mobile Application Development Practical	Core	-	-	6	-	4	40	60	100

Learning Objective	
LO1	Understand the concepts of counter and dialogs.
LO2	Concepts of Layout Managers. Perform sending email on audio and video. To enable the applications of audio and video.
LO3	To apply Local File Storage and Development of files.
LO4	To determine the concepts of Simple Animation To apply searching pages.
LO5	Usage of Student mark sheet- preparation in MAD. Concepts of processing Sqlite are implemented.

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

Course Outcomes	
CO	On completion of this course, students will able to
CO1	Understand the concepts of counter and dialogs.

CO2	Concepts of Layout Managers. Perform sending email on audio and video. To enable the applications of audio and video.
CO3	To apply Local File Storage and Development of files.
CO4	To determine the concepts of Simple Animation To apply searching pages.
CO5	Usage of Student mark sheet- preparation in MAD. Concepts of processing Sqlite are implemented.

Mapping with Programme Outcomes:

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

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCSE3A	**Cryptography**	**Elective**	**5**	**-**	**-**	**-**	**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.	**15**
II	**Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Mono alphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	**15**
III	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm.	**15**
IV	**Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: Secure Socket Layer and Transport Layer Security – Secure Electronic Transaction.	**15**
V	**Intruders** –- Intrusion Techniques - Intrusion Detection - Approaches to Intrusion Detection - **Malicious software** - Backdoor or Trapdoor - Logic Bomb - Trojan Horse – Zombie – **Firewalls** - Firewall Limitations - Firewalls – Packet Filters - Attacks on Packet Filters	**15**
	Total Hours	**75**

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 and Practices".
Reference Books	
1.	**Behrouz A. Foruzan,** "Cryptography and Network Security", Tata McGraw-Hill, 2007.
2	**AtulKahate**, "*Cryptography and Network Security*", Second Edition, 2003,TMH.
3	**M.V. Arun Kumar**, "*Network Security*", 2011, First Edition,USP.
	Web Resources
1	https://www.tutorialspoint.com/cryptography/
2	https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	3	2
CO2	3	2	3	2	3	3
CO3	3	3	3	2	3	3
CO4	2	3	3	3	2	3
CO5	3	2	3	3	3	3
Weightage of course contributed to each PSO	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	Marks		
								CIA	External	Total
23UCSE3B	**Human Computer Interaction**	**Elective**	**5**	**-**	**-**	**-**	**3**	**25**	**75**	**100**

Learning Objectives	
LO1	To learn about the foundations of Human Computer Interaction.
LO2	To learn the design and software process technologies.
LO3	To learn HCI models and theories.
LO4	To learn Mobile Ecosystem.
LO5	To learn the various types of Web Interface Design.

UNIT	Details	No. of Hours
I	**FOUNDATIONS OF HCI :** The Human: I/O channels – Memory - Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; - Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies	15
II	**DESIGN & SOFTWARE PROCESS:** Interactive Design:- Basics – process – scenarios Navigation: screen design Iteration and prototyping.- HCI in software process: - Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design	15
III	**MODELS AND THEORIES:** HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.	15
IV	**Mobile HCI:** Mobile Ecosystem: Platforms, Application frameworks - Types of Mobile Applications: Widgets, Applications, Games - Mobile Information Architecture, Mobile 2.0 - Mobile Design: Elements of Mobile Design, Tools. - Case Studies	15
V	**WEB INTERFACE DESIGN:** Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Understand the fundementals of HCI.	PO1
CO2	Understand the design and software process technologies.	PO1, PO2
CO3	Understand HCI models and theories.	PO4, PO6
CO4	Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design.	PO4, PO5
CO5	Understand the various types of Web Interface Design.	PO3, PO4
Text Book		
1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale," Human -Computer Interaction‖", III Edition, Pearson Education, 2004 (UNIT I, II & III)	
2	Brian Fling, ―" Mobile Design and Development", I Edition, O'Reilly Media Inc., 2009(UNIT–IV)	
3	Bill Scott and Theresa Neil, ―Designing Web Interfaces‖, First Edition, O'Reilly, 2009. (UNIT-V)	
Reference Books		
1.	Shneiderman, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", V Edition, Pearson Education.	
Web Resources		
1.	https://www.interaction-design.org/literature/topics/human-computer-interaction	
2.	https://link.springer.com/10.1007/978-0-387-39940-9_192	
3.	https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
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 of course contributed to each PSO	**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	Marks		
								CIA	External	Total
23UCSE4A	**Data Mining and Warehousing**	**Core**	**5**	**-**	**-**	**-**	**3**	**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	**Details**	**No. of Hours**
I	**DATA MINING:** Introduction - Steps in KDD - System Architecture – Types of data -Data mining functionalities - Classification of data mining systems - Integration of a data mining system with a data warehouse - Issues - Data Preprocessing - Data Mining Application	15
II	**DATA WAREHOUSE:** Data warehousing components - Building a data warehouse - Multi Dimensional Data Model - OLAP Operation in the Multi-Dimensional Model - Three Tier Data Warehouse Architecture - Schemas for Multi-dimensional data Model - Online Analytical Processing (OLAP) - OLAP Vs OLTP Integrated OLAM and OLAP Architecture	15
III	**ASSOCIATION RULE MINING:** Mining frequent patterns - Associations and correlations - Mining methods - Finding Frequent itemset using Candidate Generation - Generating Association Rules from Frequent Itemsets - Mining Frequent itemset without Candidate Generation - Mining various kinds of association rules - Mining Multi-Level Association Rule- Mining MultiDimensional Association Rule.	15
IV	**CLASSIFICATION AND PREDICTION:** Classification and prediction - Issues Regarding Classification and Prediction - Classification by Decision Tree Induction - Bayesian classification - Baye's Theorem - Naïve Bayesian Classification - Bayesian Belief Network - Rule based classification - Classification by Back propagation.	15
V	**CLUSTERING, APPLICATION AND TRENDS IN DATA MINING**: Cluster analysis - Types of data in Cluster Analysis - Categorization of major clustering methods -Partitioning methods - Hierarchical methods - Density-based methods- Outlier analysis - Social Impacts of Data Mining.	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", 2022, Harcourt India Pvt. Ltd, New Delhi.	
References Books (Latest editions)		
1.	K.P. Soman, Shyam Diwakar, V. Ajay "Insight into Data Mining Theory and Practice ",Prentice Hall of India Pvt. Ltd, New Delhi	
2.	Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques', Cambridge University Press, 2019	
Web Resources		
1.	https://www.topcoder.com/thrive/articles/data-warehousing-and-data-mining#:~:text=Data%20warehousing%20is%20a%20method,compiled%20in%20the%20data%20warehouse.	
2.	https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing	
3.	https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
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**
Weightage of course contributed to each PSO	**14**	**13**	**14**	**14**	**14**	**13**

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23UCSE4B	**Artificial Intelligence**	**Elective**	**5**	**-**	**-**	**-**	**3**	**25**	**75**	**100**

Learning Objectives	
LO1	To learn various concepts of AI Techniques.
LO2	To learn various Search Algorithm in AI.
LO3	To learn probabilistic reasoning and models in AI.
LO4	To learn about Learning Process.
LO5	To learn various type of Reinforcement learning.

UNIT	Details	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	15
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	15
III	Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.	15
IV	Learning : Forms of learning-Supervised Learning-Learning Decision trees-Evaluating and choosing the Best Hypothesis-Theory of Learning-Regression and classification with linear models-Artificial Neural Networks-Nonparametric models	15
V	Reinforcement Learning : Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning	15
	Total	**75**

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 Learning Process.	PO4, PO5, PO6

5	Understand various type of Reinforcement learning Techniques.	PO3, PO4
Text Book		
1	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall.	
	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill	
Reference Books		
1.	Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.	
2.	Saroj Kaushik, "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 of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

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