THIRUVALLUVAR UNIVERSITY

BACHELOR OF COMPUTER APPLICATIONS DEGREE COURSE

CBCS PATTERN

(With effect from 2022-2023 onwards)

S. No.	Part	Study Components Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3.	III	Core Theory	Paper-1	6	4	Programming in C	25	75	100
4.	III	Core Practical	Practical-1	3	2	Programming in C Lab	25	75	100
5.	III	Allied -1	Paper-1	7	3	Mathematical Foundations - I	25	75	100
6.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
7.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Total		**36**	**22**		**175**	**525**	**700**
		SEMESTER II					**CIA**	**Uni. Exam**	**Total**
8.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9.	II	English (CE)	Paper-2	4	4	**Communicative English II**	25	75	100
10.	**II**	**NMSDC I : Language Proficiency for Employability**	**Paper-1**	**2**	**2**	**Effective English**	**25**	**75**	**100**
11.	III	Core Theory	Paper-2	5	4	C++ and Data Structures	25	75	100
12.	III	Core Practical	Practical-2	2	2	C++ and Data Structures Lab	25	75	100
13.	III	Allied-1	Paper-2	7	5	Mathematical Foundations - II	25	75	100
14.	**III**	**PE**	**Paper 2**	**6**	**3**	**Professional English II**	25	75	100
15.	IV	Value Education		2	2	Value Education	25	75	100
16.	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Total		**36**	**27**		**200**	**600**	**800**
SEMESTER III							**CIA**	**Uni. Exam**	**Total**
16.	I	Language	Paper-3	6	4	Tamil / Other Languages	25	75	100

17.	II	English	Paper-3	6	4	English	25	75	100
18.	III	Core Theory	Paper-3	3	4	Programming in JAVA	25	75	100
19.	III	Core Practical	Practical-3	3	3	Programming in JAVA Lab	25	75	100
20.	III	ALLIED-2	Paper-3	7	3	Financial Accounting-I	25	75	100
21.	IV	Skill based Subject I	Paper-1	3	2	Web Technology	25	75	100
22.	IV	Non-Major Elective	Paper-1	2	2	Introduction to Information Technology	25	75	100
		Sem. Total		**30**	**22**		**175**	**525**	**700**
SEMESTER IV							**CIA**	**Uni. Exam**	**Total**
23.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
24.	II	English	Paper-4	6	4	English	25	75	100
25.	III	Core Theory	Paper-6	3	4	Relational Database Management Systems	25	75	100
26.	III	Core Practical	Practical-4	3	3	RDBMS Lab	25	75	100
27.	III	ALLIED-2	Paper-4	7	5	Financial Accounting-II	25	75	100
28.	**IV**	**NMSDC II : Digital Skills for Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	25	75	100
29.	IV	Non-Major Elective	Paper-2	2	2	Internet Technology	25	75	100
		Sem. Total		**30**	**24**		**175**	**525**	**700**
SEMESTER V							**CIA**	**Uni. Exam**	**Total**
30.	III	Core Theory	Paper-9	6	4	Mobile Application Development	25	75	100
31.	III	Core Theory	Paper-10	6	4	Operating System	25	75	100
32.	III	Core Theory	Paper –11	4	2	Design and Analysis of Algorithms	25	75	100
33.	III	Core Practical	Practical-5	4	3	Mobile Applications Development-Lab	25	75	100

34.	III	Core Practical	Practical-6	4	3	Operating System-Lab	25	75	100
35.	III	Internal Elective I	Paper-1	3	3	**(Choose any one)** A. Data Mining B. Information Security C. Software Testing	25	75	100
36.	IV	Skill Based Subject III	Paper– 2	3	2	Software Engineering	25	75	100
		Sem. Total		**30**	**21**		**175**	**525**	**700**

SEMESTER VI							**CIA**	**Uni. Exam**	**Total**
37.	III	Core Theory	Paper-12	5	4	Open Source Software	25	75	100
38.	III	Core Theory	Paper-13	4	4	Python programming	25	75	100
39.	III	Core Practical	Practical-7	4	2	Python programming Lab	25	75	100
40.	III	Core Practical	Practical-8	4	2	Open Source Programming - Lab	25	75	100
41.	III	Core Project		5	5	Group/ Individual Project Work	25	75	100
42.	III	Internal Elective II	Paper-2	3	3	**(Choose any one)** 1. Big Data Analytics 2. Cryptography 3. Digital Image Processing	25	75	100
43.	III	Internal Elective III	Paper-3	3	3	**(Choose any one)** 1.Artificial Intelligence 2. System Software 3. Mobile Computing	25	75	100
44.	**III**	**NMSDC III : Emerging Technology for Employability II**	**Paper-3**	**2**	**2**	**(Choose any one)** **• PBL Android App Development** **• Machine Learning**	**25**	**75**	**100**
45.	V	Extension Activities		0	1		100	0	100
		Sem. Total		**30**	**26**		**300**	**600**	**900**
					142				**4500**

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

Bachelor of Computer Applications – 2022-2023 onwards

Programme Objectives:

1. To prepare students for careers in software industry.
2. Understanding and skills related to the use of computers and its application.
3. To impart quality computer education
4. To enhance logical computing and programming skills.
5. Identify, explain and apply fundamental structured programming techniques.

Programme Educational Objectives:

1. To impart advance knowledge about various sub-domains related to the field of computer applications.
2. To provide the strong character to uphold the spiritual and cultural values of our country to make students acceptable to both industries and higher education.
3. Graduates will be capable of attaining higher position in their professional carrier, capable to do quality research by strengthening their mathematical, scientific and basic engineering fundamentals.
4. Graduate will be capable of adopting the changing technologies, tools, and industrial environment.
6. Graduates will promote collaborative learning and spirit of team work through multidisciplinary projects and diverse professional activities.

Programme Specific Outcomes:

1. An ability to enhance the application of knowledge of theory subjects in diverse fields.
2. Develop language proficiency to handle corporate communication demands.

3. Preparing students in various disciplines of technologies such as computer applications, computer networking, software engineering, JAVA, database concepts and programming.
4. In order to enhance programming skills of the young IT professionals, the concept of project development in using the technologies learnt during the semester has been introduced.
5. To enhance knowledge in robotics, provide experimental hardware equipment for teaching the basics of robotics, robot dynamics and control, and robot system design and application.
7. To enhance logical ability and programming concepts by implementing programming lab.
8. Preparing students for future aspects by building and improving their creativity, social awareness, and general knowledge.
9. Encouraging students to convert their start-up idea to reality by implementing.
10. Ability to understand the changes or future trends in the field of computer application.
11. Ability to identify, formulate, analyse and solve problems of programming using different languages.

Programme Outcomes:

1. Acquire skills and information not only about Computer and Information Technology but also in communication, organization and management.
2. Get to learn programming languages such as C, C++, HTML, SQL, DBMS, and Networking etc
3. Develop an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
4. Ability to work in team and build leadership qualities.
5. Understand the professional, ethical, legal, security, and social issues and responsibilities in computing profession.

6. Will be able to choose appropriate techniques, skills, and tools necessary for Designing of correct models in the construction of software systems of varying complexity.
7. Recognition of the need for and ability to engage in continuing professional development.
8. Analyse impacts of computing on individuals, organizations, and society.
9. Will be well equipped with thorough knowledge of various softwares.
10. Design, implement, and evaluate a computational system to meet desired needs within realistic constraints.

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(B.C.A) – 2022-2023 onwards

Semester: I **Paper type: Core Theory – Paper 1**

Paper code: **Name of the Paper: Programming in C** **Credit: 4**

Total Hours per Week: 6 Hrs. Lecture Hours: 78 Hrs. Tutorial Hours: - Practical Hours: -

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Course Objectives

1. To understand simple algorithms,
2. To understand language constructs
3. To understand and develop programming skills in C.
4. To understand the basic concepts of decision making and looping statements.
5. To understand the concepts of arrays, structures, union, pointers and files.

Course Outcomes

1. After studied unit-1, the student will be able to understand the concepts of Constants, Variables, and Data Types, Operators and Expressions
2. After studied unit-2, the student will be able to understand the concepts of

Managing Input and Output Operations, Decision Making and Branching, Decision Making and Looping.

3. After studied unit-3, the student will be able to understand the concepts of Arrays, Character Arrays and Strings, User Defined Functions.

4. After studied unit-4, the student will be able to understand the concepts of Structure and Unions, Pointers, File Management in C.

5. After studied unit-5, the student will be able to understand the concepts of Fundamental Algorithms, Factoring Methods.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: OVERVIEW OF C **Teaching Hours: 15 Hrs.**

Overview of C: History – Importance – Sample Programs – Basic Structure – Programming Style
– Executing – Unix System – MS-DOS System - **Constants, Variables, and Data Types:** Character Set – C Token – Keyword and Identifiers – Constants – Variables – Data Types – Declaration of Storage Class – Assigning Values to Variables – Defining Symbolic Constants – Declaration – Overflow and Underflow of Data - **Operators and Expressions:** Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Special Operators – Arithmetic Expressions, Evaluation of Expressions – Precedence of Arithmetic Operators – Some Computational Problems – Type Conversions in Expressions – Operator Precedence and Associativity – Mathematical Functions .

Unit-2: MANAGING INPUT AND OUTPUT OPERATIONS **Teaching Hours: 15 Hrs.**

Managing Input and Output Operations: Reading, Writing a Character – Formatted Input, Output - **Decision Making and Branching:** Decision Making with If statement – Simple If Statement – The If…Else Statement – Nesting of If…Else Statements – The Else If Ladder – The Switch Statement- The ?: Operator – The Goto Statement - **Decision Making and Looping:** The while Statement – The do Statement – The for Statement – Jumps in Loops – Concise Test Expressions.

Unit-3: ARRAYS **Teaching Hours: 16 Hrs.**

Arrays: One-Dimensional Arrays - Declaration, Initialization of One-Dimensional Arrays – Two- Dimensional Arrays - Initializing Two-Dimensional Arrays – Multi-Dimensional Arrays – Dynamic Arrays - **Character Arrays and Strings:** Declaring and Initializing String Variables – Reading Strings from Terminal – Writing Strings to Screen – Arithmetic Operations on Characters
– Putting String Together – Comparison of Two Strings –String-Handling Functions – Table of Strings – Other Features of Strings - **User Defined Functions**: Need for User-Defined Functions – A Multi-Function Program – Elements of User-Defined Functions – Definition of Functions – Return Values and Their Types – Function Calls – Function Declaration – Category of Functions – No Arguments and No Return Values – Arguments but no return values – Arguments with Return Values – No Arguments but Returns a value – Functions that Return Multiple Values – Nesting of Functions –

Recursion – Passing Arrays, Strings to Functions – The Scope, Visibility and Lifetime of Variables –Multi file Programs.

Unit-4: STRUCTURE AND UNIONS **Teaching Hours: 16 Hrs.**

Structure and Unions: Defining a Structure – Declaring Structure Variables – Accessing Structure Members – Structure Initialization and Copying and Comparing Structure Variable – Operations on Individual Members – Arrays of Structures – Arrays within Structures – Structures within Structures – Structures and Functions – Unions – Size of Structures – Bit Fields **Pointers:** Understanding Pointers – Accessing the Address of Variable – Declaring, Initialization of Pointer Variables – Accessing a Variable through its pointer – Chain of Pointers – Pointer Expression – Pointer Increments and Scale Factor – Pointers and Arrays – Pointers and Character Strings – Array of Pointers – Pointers as Function Arguments – Functions Returning Pointers – Pointers to Functions – Pointers and Structures – Troubles with Pointers **File Management in C**: Defining and Opening a File – Closing a File – Input/Output Operations on File – Error Handling During I/O Operations – Random Access to Files – Command Line Arguments.

Unit-5: FUNDAMENTAL ALGORITHMS **Teaching Hours: 16 Hrs.**

Fundamental Algorithms: Exchanging the values of Two Variables- Counting- Summation of a Set of Numbers-Factorial Computation -Sine Function Computation –Generation of the Fibonacci Sequence-Reversing the Digits of an Integer- Base Conversion – Character to Number Conversion
- Factoring Methods: Finding the square Root of a Number –The Smallest Divisor of an Integer- The Greatest Common Divisor of the two integers- Generating Prime Numbers- Computing the Prime Factors of an integer – Generation of Pseudo-random Numbers-Raising a Number to a Large Power- Computing the nth Fibonacci Number (Chapters: 2 & 3)

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher

e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text books:

1. Programming in ANSI C, E. Balagurusamy, Tata McGrawhill Education, 6th Edition, 2013. (Unit I to IV)
2. How to Solve it by Computer, R.G.Dromey, PHI International (Unit V)

Reference Books:

1. The C Programming Language (ANSI C), Kernighan, B.W. and Ritchie, D.M., PHI.
2. C by Discovery , Foster & Foster , Penram International Publishers, Mumbai

E-References

1. NPTEL, Introduction to C Programming, Prof.SatyadevNandakumar , IIT, Computer Science and Engineering Kanpur.
2. NPTEL, Introduction to Problem Solving & Programming, by Prof. Deepak Gupta Department of Computer Science and Engineering IIT Kanpur.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	S	S	M	S
CO2	S	M	M	S	S	S	S	S	S	S
CO3	S	S	M	M	S	S	S	S	S	S
CO4	S	M	M	M	M	M	S	S	S	S
CO5	S	S	M	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(B.C.A) – 2022-2023 onwards

Semester: I **Paper type: Core Practical – Practical - 1**

Paper code: **Name of the Paper: Programming in C Lab**

Credit: 2 Total Hours per Week: 3 Hrs. Lecture Hours: Tutorial Hours:. Practical Hours:39

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Course Objectives

1. To understand concepts of for/while loop and switch.
2. To understand language Functions and recursions.
3. To understand and develop String Manipulations.
4. To understand the basic concepts of searching and sorting.
5. To understand the concepts of structures.

Course Outcomes

1. After studied , the student will be able to Enhance the analysing and problem solving skills and use the same for writing programs in C
2. After studied, the student will be able to Write diversified solutions, draw flowcharts and develop a well-documented and indented program according to coding standards
3. After studied, the student will be able to Learn to debug a given program and execute the C program
4. After studied, the student will be able to have enough practice the use of conditional and looping statements
5. After studied, the student will be able to implement arrays, functions and pointers.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No

2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

LIST OF PRACTICAL EXERCISES

Control Statements:

1. Print n Fibonacci numbers – (using for)
2. Print n Prime numbers – (using while)
3. Simple arithmetic on two numbers – (using switch/case)

Functions:

4. Swap two values using call by value / call by reference.

Recursion:

5. To compute NcR and NpR
6. To Compute GCD and LCM

String Manipulation.

7. Operations on string such as length, concatenation, reverse, counting, and copy of a string to another.

Matrices:

8. Matrix Addition, Subtraction, Multiplication, Transpose of n x m matrices.
9. Inverse of a square matrix.

Searching:

10. Binary Search.

Sorting:

11. Bubble Sort
12. Insertion Sort

Structures:

13. Students Mark statement

Pointers:

14. Arithmetic operations on pointers.

Files

15. Creating/ Reading/ Writing a text/binary file.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a) Book review and research paper review, syllabus and curriculum review.
b) Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c) Workshops, preparing technical term dictionaries from text books and reference books.
d) Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e) Forming digital library: collecting text and reference books, course material.
f) Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g) Extracurricular and cultural activities may be framed through the syllabus content.
h) Grouping students for self-discussion, self-learning process.
i) Following institution and intellectual and writing reports in the course field.
j) Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k) For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l) Extracurricular activities may be framed through their syllabus content.
m) Bring the industries to the campus. Bring the students to the industry.
n) Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Reference Book:

1. Programming in ANSI C, E. Balagurusamy, Tata McGrawhill Education, 6th Edition, 2013.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	S	S	S
CO2	S	S	M	S	S	S	S	S	S	S
CO3	S	M	M	S	S	M	S	S	S	S
CO4	S	M	M	S	M	M	S	S	S	S
CO5	S	M	M	S	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(B.C.A) – 2022-2023 onwards

Semester: I **Paper type: Allied 1 Paper - 1**

Paper code: **Name of the Paper: Mathematical Foundations– 1**

Credit: 3 Total Hours per Week: 7 Hrs.

Lecture Hours: 91 Hrs. Tutorial Hours: Practical Hours:

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Course Objectives

1.
2.
3.
4.
5.

Course Outcomes

1.
2.
3.
4.
5.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: SYMBOLIC LOGIC
Teaching Hours: 18 Hrs.

Proposition, Logical operators, conjunction, disjunction, negation, conditional and bi-conditional operators, converse, Inverse, Contra Positive, logically equivalent, tautology and contradiction. Arguments and validity of arguments.

Unit-2: SET THEORY **Teaching Hours: 18 Hrs.**

Sets, set operations, venndiagram, Properties of sets, number of elements in a set, Cartesian product, relations & functions,

Unit-3: BINARY OPERATIONS **Teaching Hours: 18 Hrs.**

Types of Binary Operations: Commutative, Associative, Distributive and identity, Boolean algebra: simple properties. Permutations and Combinations.

Unit-4: **DIFFERENTIATION** **Teaching Hours: 19 Hrs.**

Simple problems using standard limits,

$$\lim_{x \to a} \frac{x^n - a^n}{x - a}, \quad \lim_{x \to 0} \frac{\sin x}{x}, \quad \lim_{x \to 0} \frac{\tan x}{x}, \quad \lim_{x \to 0} \frac{e^x - 1}{x}, \quad \lim_{n \to \infty} (1 + 1/n)^n, \quad \lim_{n \to 0} (1+n)^{1/n}$$

Differentiation, successive differentiation, Leibnitz theorem, partial differentiation, Applications of differentiation, Tangent and normal, angle between two curves.

Unit-5: **TWO DIMENSIONAL ANALYTICAL GEOMETRY** **Teaching Hours: 18 Hrs.**

Straight Lines - Pair Straight Lines

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self discussion, self learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
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l. Bring the industries to the campus. Bring the students to the industry.
m. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. P.R. Vittal, Mathematical Foundations – Maragham Publication, Chennai.

Reference Books:

1. U. Rizwan, Mathematical Foundation - SciTech, Chennai
2. V.Sundaram& Others, Dircrete Mathematical Foundation - A.P.Publication, sirkali.
3. P.Duraipandian& Others, Analytical Geometry 2 Dimension - Emerald

publication 1992 Reprint.

4. Manicavachagompillay&Natarajan. Analytical Geometry part I - Two Dimension - S.Viswanathan (printers & publication) Put Ltd., 1991.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	S	S	S	M	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	M	S	S	S	S	S	S	S
CO4	S	S	M	S	S	M	M	S	S	S
CO5	S	S	S	S	M	M	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(B.C.A) – 2022-2023 onwards

Semester: II **Paper type: Core Theory – Paper 2**

Paper code: **Name of the Paper: C++ & Data Structures** **Credit: 4**

Total Hours per Week: 5 Hrs. Lecture Hours: 65 Hrs. Tutorial Hours:…..
Practical Hours:..

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Course Objectives

1. To understand the concepts of object-oriented programming and master OOP using C++.
2. To understand the concepts of Inheritance, polymorphism and templates.
3. To understand the concepts of different view of data, stack and queues.
4. To understand the concepts of Programming with Recursion, Binary Search Tree and graphs.
5. To understand the concepts of Sorting and Searching Algorithms

Course Outcomes

1. After studied unit-1, the student will be able to understand the concepts of object oriented programming Apply structure and inline functions.
2. After studied unit-2, the student will be able to understand the concepts of the types of inheritances and Applying various levels of Inheritance for real time problems Apply the OOPs concepts class and object. Understand Explain the file concept and exception handlings in C++
3. After studied unit-3, the student will be able to understand the concepts of Stacks and Queue using array and pointers.
4. After studied unit-4, the student will be able to understand the concepts of Recursion, Binary Search Tree and graphs.
5. After studied unit-5, the student will be able to understand the concepts of Sorting and Searching Algorithms

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: BASIC CONCEPTS OF OOPS **Teaching Hours: 13 Hrs.**

Principles of Object Oriented Programming – Beginning with C++ – Token , Expressions and Control Structures- Functions in C++ – Classes and Objects – Constructors and Destructors.

Unit-2: OPERATORS **Teaching Hours: 13 Hrs.**

Operator Overloading and Type Conversions – Inheritance: Extending Classes – Pointers, Virtual Functions and Polymorphism - Managing Console I/O Operations. Working with Files - Templates – Exception Handling – Manipulating Strings.

Unit-3: DATA DESIGN & IMPLEMENTATIONS
Teaching Hours: 13Hrs;

Hrs. Different views of data – Abstraction and Built-in Types – Arrays ADTs Stacks and Queue (Linear and Linked) , Stack (Array and Pointer)- Applications- Infix to Postfix Conversions – Queue(Array and Pointer) – List(Array and Pointer) – Applications: (Polynomial Addition) - Doubly Linked Lists.

Unit-4: GRAPH AND TREE **Teaching Hours: 13 Hrs.**

Programming with Recursion: Recursion – Verifying and Writing Recursive Functions **– Binary Search Tree :** Implementation – Tree Traversal **– Graphs:** Implementations – BFS – DFS – Dijkstras Shortest Path

Algorithm.*(Chapter 7:Section 7.1,7.4 7.5, Chapter 8:Section 8.1,8.4, Chapter 9:Section 9.3)*

Unit-5: SORTING AND SEARCHING ALGORITHMS Teaching Hours: 13 Hrs.

Sorting – Searching – Hashing *(Chapter 10: Section 10.1,10.2,10.3)*

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text books:

1. Object Oriented Programming with C++, E Balagurusamy , Tata McGraw Hill, 6th Edition, 2014. (Units I, II)
2. C++ Plus Data Structure, Nell Dale, Jones & Bartlett Publishers , 4th Edition, 2010. (Units III, VI & V)

Reference Books:

1. C++ The Complete Reference, Herbert Schildt, Tata McGraw Hill, 4th Edition, 2003.
2. OOP In ANSI C and Turbo C, Ashok N.Kamthene, Pearson Education, 6th Edition, 2008.
3. Data Structures and Algorithms, Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Addison Wesley Longman Inc., 2nd Edition, 1999.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	M	S	S	S	S
CO2	S	M	M	S	S	M	S	M	S	S
CO3	S	M	S	S	M	S	S	S	S	M
CO4	S	S	M	S	M	S	S	S	M	S
CO5	S	S	S	M	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(B.C.A) – 2022-2023 onwards

Semester: II Paper type: Core Practical – Practical - 2

Paper code: Name of the Paper: C++ & Data structures Lab Credit:

2 Total Hours per Week: 2 Hrs. Lecture Hours: Tutorial

Hours:. Practical Hours:26 Hrs.

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Course Objectives

1. To develop C++ programming skills in design
2. To understand the basic concepts of different abstract types and structure of data.
3. To understand the concepts of Function Overloading
4. To understand the concepts of Stack, Queue, List, Doubly Linked List - using Pointers- using Arrays.
5. To understand the concepts of Searching and Sorting Algorithms.

Course Outcomes

1. Understand the Creating and Deleting the Objects with the Concepts of Constructors and Destructors.
2. Demonstrate the Polymorphism Concepts and Operator Overloading.
3. Understand basic Data Structures such as Arrays, Linked Lists, Stacks, Queues, Doubly Linked List and Infix to Postfix Conversion.
4. Apply Algorithm for solving problems like Sorting and Searching.
5. Apply Algorithms and use Graphs and Trees as tools to visualize and simplify Problems

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

LIST OF PRACTICAL EXERCISES

1. Constructors & Destructors, Copy Constructor.

2. Friend Function & Friend Class.

3. Inheritance.

4. Polymorphism & Function Overloading.

5. Virtual Functions.

6. Overload Unary & Binary Operators Both as Member Function & Non Member Function.

7. Class Templates & Function Templates.

8. Exception Handling Mechanism.

9. Standard Template Library concept.

10. File Stream classes.

11. Array implementation of Stack, Queue : Infix to postfix

12. Implementation of Stack, Queue, List, Doubly Linked List - using Pointers- Polynomial Addition

13. Implementation of Binary Search Tree, Traversal

14. Implementation of Searching and Sorting Algorithms.

15. Graph Implementation of shortest path (Djikstra's)

Reference Books:

1. Object Oriented Programming with C++, E Balagurusamy , Tata McGraw Hill, 6th Edition, 2014.
2. C++ Plus Data Structure, Nell Dale, Jones & Bartlett Publishers , 4th Edition, 2010

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.

b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.Grouping students for self-discussion, self-learning process.
h. Following institution and intellectual and writing reports in the course field.
i. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
j. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
k. Extracurricular activities may be framed through their syllabus content.
l. Bring the industries to the campus. Bring the students to the industry.
m. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Reference Book:

1. Programming in ANSI C, E. Balagurusamy, Tata McGrawhill Education, 6th Edition, 2013.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	M	S	S	S	S
CO2	S	M	M	M	S	S	S	M	S	S
CO3	S	M	M	M	M	S	S	S	S	S
CO4	S	M	M	S	M	S	M	M	S	S
CO5	S	S	S	M	M	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

Bachelor of Computer Applications (B.C.A) – 2022-2023 onwards

Semester: II Paper type: Allied 1 Paper 2

Paper code: Name of the Paper : Mathematical Foundations Credit: 5

Total Hours per Week: 7 Hrs. Lecture Hours: 91 Hrs. Tutorial Hours:…..
Practical Hours:..

……
……

Course Objectives

1.
2.
3.
4.
5.

Course Outcomes

1.
2.
3.
4.
5.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

UNIT-1: Application of Integration **Teaching Hours: 18 Hrs.**

Evaluation of double, triple integrals - Simple applications to area, volume -Fourier series for functions in (0,2) and

UNIT-2: Partial Differential Equations **Teaching Hours: 18 Hrs.**

Formation, complete integrals and general integrals - Four standard types, Lagrange's equations.

UNIT-3: Laplace Transforms **Teaching Hours: 19 Hrs.**

Laplace Transformations of standard functions and simple properties - Inverse Laplace transforms - Applications to solutions of linear differential equations of order 1 and 2-simple problems

UNIT-4 : Vector Analysis **Teaching Hours: 18 Hrs.**

Scalar point functions - Vector point functions - Gradient, divergence, curl - Directional derivatives - Unit to normal to a surface.

UNIT-5: Vector Analysis (continued) **Teaching Hours: 18 Hrs.**

Line and surface integrals - Guass, Stoke's and Green's theorems (without proofs) - Simple problem based on these Theorems.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus

content.

h. Grouping students for self discussion, self learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics*, Vol. I & II.Muhil Publishers, Chennai

Reference Books:

1. P.Balasubramanian and K.G.Subramanian,(1997)*Ancillary Mathematics*. Vol. I & II. Tata McGraw Hill, New Delhi.
2. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II.VikasPublications, New Delhi.
3. P.R.Vittal(2003). *Allied Mathematics* .Marghan Publications, Chennai.
4. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand& company Ltd., New Delhi-55.
5. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	S	S	M	S	M
CO2	S	S	S	M	M	S	S	S	S	S
CO3	M	M	M	S	S	M	M	S	M	S
CO4	M	S	M	S	S	M	M	M	M	M
CO5	M	M	S	S	S	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

Bachelor of Computer Applications (B.C.A) – 2022-2023 onwards

Semester: II **Paper type: Allied - Paper 2**

Paper code: **Name of the Paper: Mathematical Foundations – 2**

Credit: 5

Total Hours per Week: 7 Hrs. Lecture Hours: 91 Hrs. Tutorial Hours:…..

Practical Hours:..

……
……

Course Objectives

1.
2.
3.
4.
5.

Course Outcomes

1.
2.
3.
4.
5.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes

4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

UNIT-I: MATRICES **Teaching Hours: 18 Hrs.**

Multiplication of matrices, Singular and Non-Singular matrices, Adjoint of a Matrix, Inverse of a matrix Symmetric and Skew-Symmetric, Hermitian and Skew-Hermition, Orthogonal and unitary matrices, Rank of a matrix, Solution of Simultaneous Linear equations by

i. Cramer's rule.
ii. Matrix Inversion Method.

UNIT-II: MATRICES **Teaching Hours: 18 Hrs.**

Test for Consistency and Inconsistency of linear equations, (Rank Method), characteristic roots and characteristic vectors, Cayley - Hamilton theorem, matrix of linear transformations: reflection about the x, y axes and the line y=x, rotation about the origin through an angle, expansion or compression, shears, translation.

UNIT-III INTEGRATION **Teaching Hours: 19 Hrs.**

Integration Simple problems, integration of rational function involving algebraic expressions of the form

$$\frac{1}{\sqrt{ax^2+bx+c}}, \frac{1}{\sqrt{ax^2+bx+c}}, \frac{px+q}{\sqrt{ax^2+bx+c}}, \frac{px+q}{\sqrt{ax^2+bx+c}}$$

integrations using simple substitutions integrations involving trigonometric functions of the form

$\frac{1}{a+b\cos x}$, $\frac{1}{a^2\sin^2 x+b^2\cos^2 x}$,

Integration by parts.

UNIT-IV PROPERTIES OF DEFINITE ITEGRALS Teaching Hours: 18 Hrs.

Properties of definite integrals. Reduction formulae for

$\int x^n e^{ax} dx$, $\sin^n x dx$, $\cos^n x dx$, $\int x^m (1-x)^n dx$, applications of integration for (i) Area under plane caurves, (ii) Volume of solid of revolution.

UNIT-V: ANALYTICAL GEOMETRY OF THREE DIMENSION Teaching Hours: 18 Hrs.

Planes, straight lines.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
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g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self discussion, self learning process.Following institution and intellectual and writing reports in the course field.
i. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.

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k. Extracurricular activities may be framed through their syllabus content.
l. Bring the industries to the campus. Bring the students to the industry.
m. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

P.R.Vittal, Mathematical Foundations - Margham Publication, Chennai.

Reference Books:

1. U. Rizwan, Mathematical Foundation - SciTech, Chennai
2. V.Sundaram& Others, Dircrete Mathematical Foundation - A.P.Publication, sirkali.
3. P.Duraipandian& Others, Analytical Geometry 3 Dimension – Emerald publication 1992 Reprint.
4. Manicavachagompillay&Natarajan. Analytical Geometry part II - three Dimension - S.Viswanathan (printers & publication) Put Ltd., 1991.

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	S	S	S	S
CO2	S	M	M	M	M	S	S	S	S	S
CO3	S	S	S	M	M	S	S	M	S	S
CO4	S	M	M	M	S	S	S	M	S	S
CO5	S	S	M	M	M	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(B.C.A) - 2022-2023 onwards

Semester: III **Paper type: Core theory Paper 3**

Paper code: **Name of the Paper: Programming in Java**
Credit:4

Total Hours per Week: 5 **Lecture Hours: 65** **Tutorial Hours:**
Practical Hours:

……

Course Objectives

1. To learn the concepts of java and practice it.
2. To get insight knowledge in object-oriented programming.
3. To study the concepts of java paradigms.
4. To master the java concepts.
5. To gather programming knowledge in java.

Course Outcomes (five outcomes for each units should be mentioned)

CO1. After studied unit-1, the student will be able to know about the object-oriented concepts in java.

CO2. After studied unit-2, the student will be able to know about primitive data types and operators.

CO3. After studied unit-3, the student will be able towork with arrays,control structures and handling exceptions.

CO4. After studied unit-4, the student will be able to work with files and packages.

CO5. After studied unit-5, the student will be able to know about Applets and GUI concepts.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	Yes	No
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	No	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	Yes
5	Yes	Yes	No	Yes	No	Yes

Unit-1: INTRODUCTION **Teaching Hours: 15 Hrs.**

Declarations and Access Control: Identifiers and Keywords: Oracle‘s Java Code Conventions. Define Classes: Import Statements and the Java API - Static Import Statements. Use Interfaces: Declaring an Interface-Declaring Interface Constants. Declare Class Members: Access Modifiers - No access Member Modifiers - Constructor Declarations – Variable Declarations. Declare and Useenums: Declaring enums. Object Orientation: Encapsulation- Inheritance and Polymorphism-Polymorphism - Overriding / Overloading: Overridden Methods -Overloaded

Unit-2: OBJECTS ORIENTATION **Teaching Hours: 15 Hrs.**

Object Orientation: Casting - Implementing an Interface - Legal Return Types: Return Type Declarations - Returning a Value. Constructors and Instantiation: Overloaded Constructors - Initialization Blocks. Statics: Static Variables and Methods. Assignments: Stack and Heap - Literals, Assignments, and Variables: Literal Values for All Primitive Types. Scope - Variable Initialization - Passing Variables into Methods: Passing Object Reference Variables - Passing Primitive Variables. Garbage Collection. Operators: Java Operators - Assignment Operators -Relational Operators - instanceof Comparison - Arithmetic Operators - Conditional Operator - Logical Operators.

Unit-3: STRINGS AND ARRAYS

Teaching Hours: 15 Hrs.

Working with Strings, Arrays, and Array Lists: Using String and String Builder: The String Class - The StringBuilder Class - Important Methods in the String Builder Class. Using Arrays: Declaring an Array -Constructing an Array- Initializing an Array. Using Array List: Array List Methods in Action - Important Methods in the Array List Class. Flow Control and Exceptions: Using if and switch Statements -Creating Loops Constructs- Handling Exceptions - Catching an Exception Using try and catch - Using finally. String Processing, Data Formatting Resource Bundles: String, String Builder, and String Buffer -Dates, Numbers, Currencies, and Local

Unit-4: FILE **Teaching Hours: 15 Hrs.**

I/O and NIO: File Navigation and I/O: Creating Files Using the File Class - Using File Writer and File Reader. File and Directory Attributes -Directory Stream - Serialization. Generics and Collections: to String(), hash Code(), and equals(): The to String() Method - Generic Types -Generic Methods - Generic Declarations. Inner Classes: Method – Local. Inner Classes - Static Nested Classes - Threads: Defining, Instantiating, and Starting Threads - Thread States and Transitions - Synchronizing Code, Thread Problems - Thread Interaction. Concurrency: Concurrency with the java. util. concurrent Package - Apply Atomic Variables and Locks - Use java. util.concurrent Collections - Use Executors and Thread Pools.

Unit-5: APPLETS **Teaching Hours: 15 Hrs.**

Applets: Applet fundamentals - Applet class - Applet life cycle - Steps for developing an applet program - Passing values through parameters -Graphics in an applet - Event-handling. GUI Applications - Part 1: Graphical user interface - Creating windows - Dialog boxes - Layout managers - AWT component classes - Swing component classes. GUI Applications - Part 2: Event handling - Other AWT components - AWT graphics classes - Other swing controls.

Textbooks:

1. Kathy Sierra, Bert Bates — OCA/OCP Java SE 7 Programmer I & II Study Guide, Oracle Press. (Unit I,II,III,IV).

2. Sagayaraj, Denis, Karthik and Gajalakshmi, 2018, Java Programming - For Core and Advanced Learners, University Press (India) Private Limited, Hyderabad. (Unit V).

Reference Books:

1. Hebert Schild, 2002, The Complete Reference Java2, [Fifth Edition]. Tata McGraw-Hill, New Delhi.

2. John Hubbard, R.2004. Programming with Java. [Second Edition]. Tata McGraw-Hill, New Delhi.

3. Debasish Jana. 2005. Java and Object-Oriented Programming Paradigm, [SecondPrinting]. Prentice-Hall of India, New Delhi.

4. Sagayaraj, Denis, Karthik and Gajalakshmi 2018, Java Programming for core and advanced Learners, University Press India Pvt. Ltd., Hyderabad.

E- References:

1. www.tutorialspoint.com/java/java-quick-guide.htm

2. www.tutorialspoint.com/java/java_overview.htm

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	M	S	S
CO2	S	M	S	S	S	S	M	S	M	S
CO3	M	S	M	S	S	M	S	M	S	M
CO4	S	M	S	M	S	S	S	M	M	S
CO5	S	S	M	M	S	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(B.C.A) - 2022-2023 onwards

Semester: III **Paper type: Core Practical - Practical 3**

Paper code: **Name of the Paper: Programming in Java lab**

Credit: 3

Total Hours per Week: 4 **Lecture Hours:** **Tutorial Hours:**

Practical Hours: 52

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Course Objectives

1. To use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
2. To read and make elementary modifications to Java programs that solve real-world problems.
3. To be able to create an application using string concept.
4. To be able to create a program using files in application.
5. To be able to create an Applet to create an application and identify and fix defects and common security issues in code.

Course Outcomes

- CO1. After studied unit-1, the student will be able to know about the working of object-oriented concepts in java.
- CO2. After studied unit-2, the student will be able to practically know about primitive data types and operators.
- CO3. After studied unit-3, the student will be able to practically work with arrays, control structures and handling exceptions.
- CO4. After studied unit-4, the student will be able to practically work with files and packages.
- CO5. After studied unit-5, the student will be able to practically know about Applets and GUI concepts.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	Yes	Yes	Yes	No	Yes
4	Yes	No	Yes	No	Yes	Yes
5	Yes	No	No	Yes	Yes	Yes

List of Practical Exercises:

1.Implementation of Classes and Objects

2. Implementation of Inheritance and Polymorphism

3. Implementation of Interface and Package concepts

4. Implementation of Flow, Border, Grid Layouts

5. Implementation of Tic-Tac Toe Application Using Applets

6. Implementation of Frames, Menus, Dialog

7. Implementation of Swing concepts

8. Implementation of Exception Handling

9. Implementation of Multi-Threading

10. Implementation of I/O Streams

11. Implementation of Java Networking concepts

12. Implementation of Java Servlets (Connecting Database)

13. Implementation of RMI

14. Implementation of Java Beans.

Textbooks:

1. Kathy Sierra, Bert Bates — OCA/OCP Java SE 7 Programmer I & II Study Guide,

Oracle Press. (Unit I, II, III, IV).
2. Sagayaraj, Denis, Karthik and Gajalakshmi, 2018, Java Programming - For Core and Advanced Learners, University Press (India) Private Limited, Hyderabad. (Unit V).

Reference Books:

1. Hebert Schild, 2002, The Complete Reference Java2, [Fifth Edition]. Tata McGraw-Hill, New Delhi.
2. John Hubbard, R.2004. Programming with Java. [Second Edition]. Tata McGraw-Hill, New Delhi.
3. Debasish Jana. 2005. Java and Object-Oriented Programming Paradigm, [Second Printing]. Prentice-Hall of India, New Delhi.
4. Sagayaraj, Denis, Karthik and Gajalakshmi 2018, Java Programming for core and advanced Learners, University Press India Pvt. Ltd., Hyderabad.

E- References:

1. www.tutorialspoint.com/java/java-quick-guide.htm
2. www.tutorialspoint.com/java/java_overview.htm

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	S	M	S	M
CO2	S	M	M	S	S	S	M	S	S	S
CO3	M	S	S	S	S	M	S	S	S	M
CO4	S	S	S	M	S	M	S	M	M	S
CO5	S	S	S	M	S	S	M	S	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(B.C.A) - 2022-2023 onwards

Semester: III **Paper type: Allied 2 Paper 3**

Paper code: **Name of the Paper: FINANCIAL ACCOUNTING I**

Credit: 3

Total Hours per Week: 7 **Lecture Hours: 91** **Tutorial Hours:**

Practical Hours:

……

COURSE OBJECTIVES:

- The objective of this paper is to help the students to acquire conceptual knowledge of accounting.

COURSE OUTCOMES:

On the successful completion of the course, the student will be able

CO NUMBER	CO STATEMENT

CO1 To introduce the basic concepts and conventions to the students, this would help in development of accounting knowledge.

CO2 To understand the concept of Double entry system this helps in preparation of various books of accounts.

CO3 To develop the capability of students to prepare the Final Accounts of a Small Business Concern.

CO4 To introduce the concept of Single entry system of Accounting which helps them to prep the accounts from incomplete records.

CO5 To enhance the Accounting Knowledge by introducing the practical uses of Average Due Date and Bank Reconciliation Statement.

Unit-I

INTRODUCTION TO ACCOUNTING Teaching Hrs. : 10 Hrs.

Meaning- Definition- Functions- Objectives- Users of Accounting Information- Accounting Concepts and Conventions – Advantages and Limitations of Accounting.

Unit-II DOUBLE ENTRY SYSTEM OF ACCOUNTING

Teaching Hrs. : 12 Hrs.

Meaning and concepts - Golden Accounting Rules- Journal Entries- Ledger- Trail Balance – Rectification of Errors (Simple Problems).

Unit-III FINAL ACCOUNTS Teaching Hrs, : 10 Hrs.

Preparation of Trading Account, Profit and Loss Account and Balance Sheet- Adjustment Entries (Simple Problems).

Unit-IV SINGLE ENTRY SYSTEM Teaching Hrs. : 10 Hrs.

Meaning - Features - Advantages - Limitations - Methods- Net Worth Method – Conversion Method (Simple Problems).

Unit-V AVERAGE DUE DATE AND BANK RECONCILIATION STATEMENT

Teaching Hrs. : 10 Hrs.

Average Due Date - Meaning -Uses – Problems - Bank Reconciliation Statement- Meaning- Reasons for Preparation- Procedures and Preparation of Bank Reconciliation statement (Simple Problems).

TEXTBOOK

S.No	Author	Title	Publisher	Year of Publication
1	T.S.Reddy and Murthy	Financial Accounting	Margham Publications	2018

REFERENCE BOOKS

S.No	Author	Title	Publisher	Year of Publication
1	M.C. Shukla and T.S. Grewal&co	Advanced Accounts	S. Chand & Co	2016
2	R.L. Gupta	Financial Accounting	Sultan chand	2014
3	S.P. Jain &K.L Narang,	Financial Accounting	Kalyani Publication	2017

4	R.S.N Pillai&V.Bagavathi	Fundamental of Advanced Accounting, Volume – I	S. Chand & Co	2013

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(B.C.A) - 2022-2023 onwards

Semester: III **Paper type: Skill Based Subject 1 Paper - 1**

Paper code: **Name of the Paper: Web Technology**

Credit: 2

Total Hours per Week: 3 **Lecture Hours: 39** **Tutorial Hours:**

Practical Hours:

……

Course Objectives

1. This course introduces the concepts of HTML.ASP, VB Script,
2. This course introduces the concepts of control statements and looping statements in Java script.
3. This course introduces the concepts of Java Script Cookies.
4. This course introduces the concepts of ASP.NET
5. This course introduces the concepts of OLEDB connection.

Course Outcomes

- CO1. After studied unit-1, The Student will be able to understand the concepts of HTML.
- CO2. After studied unit-2, The Student will be able to understand the concepts of java scripts.
- CO3. After studied unit-3, The Student will be able to understand the concepts of user defined functions.
- CO4. After studied unit-4, The Student will be able to understand the concepts of Active Server Page.
- CO5. The student will be able to understand the concepts of – OLEDB connection class.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	No	Yes	No
2	Yes	No	Yes	Yes	Yes	Yes
3	Yes	Yes	No	Yes	No	Yes
4	Yes	Yes	Yes	No	Yes	Yes

5	Yes	Yes	Yes	Yes	No	Yes

Unit-1: INTRODUCTION TO VBSCRIPT

Teaching Hours: 7 Hrs

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

Unit-2: INTRODUCTION TO JAVASCRIPT

Teaching Hours: 8 Hrs

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

Unit-3: JAVASCRIPT DOCUMENT OBJECT MODEL

Teaching Hours: 8 Hrs

Javascript document object model – Introduction – Object in HTML – Event Handling – Window object – Document object – Browser object – Form object – Navigator object – Screen object – Build in object – User defined object – Cookies.

Unit-4: ASP.NET

Teaching Hours: 8 Hrs

ASP.NET Language Structure – Page Structure – Page event, Properties & Compiler Directives. HTML server controls – Anchor, Tables, Forms, Files. Basic Web server Controls – Label, Text box, Button, Image Links, Check & radio Button, Hyperlink, Data List Web Server Controls – Check box list. Radio button list, Drop down list, List box, Data grid, Repeater.

Unit-5: ERROR HANDLING AND SECURITY

Teaching Hours: 8 Hrs

Request and Response Objects, Cookies, Working with Data – OLEDB connection class, command class, transaction class, data adaptor class, data set class. Advanced issues – email, Application issues, working with IIS and page Directives, error handling. Security – Authentication, IP Address, Secure by SSL & Client Certificates.

TEXTBOOKS:

1. I.Bayross, 2000, Web Enable Commercial Application Development Using HTML, DHTML, Javascript, Perl CGI, BPB Publications.
2. A. Russell Jones, Mastering Active Server Pages 3, BPB Publications.

REFERENCE BOOKS:

1. HathleenKalata, Internet Programming with VBScript and JavaScript, Thomson Learning
2. Mike McGrath, XML Harness the Power of XML in easy steps, Dreamtech Publications
3. T.A. Powell, 2002, Complete Reference HTML, TMH.
4. J. Jaworski, 1999, Mastering Javascript, BPB Publications.
5. Powell, Thomas; Schneider, Fritz, JavaScript: The Complete Reference, 2nd edition2004, TMH

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	M	S	M	S	M	S	S

CO4	S	M	S	M	S	S	S	M	M	S
CO5	M	S	S	M	S	S	M	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(B.C.A) - 2022-2023 onwards

Semester: III **Paper type: Non Major Elective Paper - 1**

Paper code: **Name of the Paper: Introduction to Information Technology**

Credit: 2

Total Hours per Week: 2 **Lecture Hours: 26** **Tutorial Hours:**

Practical Hours:

……

Course Objectives

The subject aims to build the concepts regarding:

1. Major components of Computer System and its working principles.
2. Role of an Operating System and basic terminologies of networks.
3. How the Information Technology aids for the Current Scenario.
4. To understand the Computer Software.
5. To understand internet applications

Course Outcomes

1. After studied unit-1, the student will be able to understand the Major components of Computer System and its working principles.
2. After studied unit-2, the student will be able to know the Role of an Operating System and basic terminologies of networks.
3. After studied unit-3, the student will be able to know How the Information Technology aids for the Current Scenario.
4. After studied unit-4, the student will be able to understand the Computer Software
5. After studied unit-5, the student will be able to understand internet applications

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION **Teaching Hours: 6 Hrs.**

Characteristics of Computers-Technological Evolution of Computers-The Computer Generations-Categories of Computer. **Data and Information:** Introduction-Types of Data-A Simple Model of a Computer-Data Processing Using a Computer-Desktop Computer. **Acquisition of Number and Textual Data:** Introduction- Input Units-Internal Representation of Numeric Data-Representation of Characters in Computers–Error-Detecting Codes.

Unit-2: DATA STORAGE **Teaching Hours: 5 Hrs.**

Introduction-Memory Cell-Physical Devices Used as Memory Cells-Random Access Memory- Read Only Memory- Secondary Memory- Floppy Disk Drive- Compact Disk Read Only Memory (CDROM)-Archival Memory. **Central Processing Unit:** The Structure of a Central Processing Unit-Specification of a CPU-Interconnection of CPU with Memory and I/O Units.

Unit-3: COMPUTER NETWORKS **Teaching Hours: 5 Hrs.**

Introduction-Local Area Network (LAN)- Applications of LAN-Wide Area Network (WAN)–The Future of Internet Technology. **Output Devices:** Introduction- Video Display Devices-Flat Panel Displays–Printers.

Unit-4: COMPUTER SOFTWARE

Teaching Hours: 5 Hrs.

Introduction-Operating System-Programming Languages–A Classification of Programming Languages. **Data Organization:** Introduction-Organizing a Database-Structure of a Database- Database Management System-Example of Database Design.

Unit-5: SOME INTERNET APPLICATIONS **Teaching Hours: 5 Hrs.**

Introduction- E-mail- Information Browsing Service- The World Wide Web-

Information Retrieval from the World-Wide-Web -Other Facilities Provided by Browsers - Audio on the Internet. **Societal Impacts of Information Technology:** Careers in Information Technology.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. Rajaraman, V.2008.IntroductiontoInformationTechnology.[SixthPrinting]. PrenticeHall of India Pvt. Limited, New Delhi.(UNIT I toV)

2. Nagpal, D.P.2010.ComputerFundamentals.[FirstEdition,Revised].S.Chand &CompanyLtd, New Delhi. (UNIT I(Introduction: Characteristics of Computers to Categories of Computer))

Reference Books:

1. ITL EducationsSolution Limited. 2009. **Introduction toComputer Science**. [Fourth Impression].Pearson Education, New Delhi.
2. Alexis Leon and Mathews Leon. 1999. **Fundamentals of Information Technology.**[FirstEdition]. Leon TECHWorld, New Delhi.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	M	M	S
CO2	S	S	S	M	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(B.C.A) - 2022-2023 onwards

Semester: IV **Paper type: Core theory Paper 6**

Paper code: **Name of the Paper: Relational Database Management Systems**

Credit:4

Total Hours per Week: 5 **Lecture Hours: 65** **Tutorial Hours:**

Practical Hours:

……

Course Objectives

1. The students are able to understand database concepts and database management system software and have a high-level understanding of major DBMS components and their function.
2. The students are able to understand the E R model and relational model.
3. The students are able to be able to write SQL commands to create tables and indexes, insert/update/delete data, and query data in a relational DBMS.
4. The students are able to Understand Functional Dependency and Functional Decomposition.
5. The students are able to understand the architecture of database management system and also understand the various different architecture such as server system architecture, parallel systems and distributed database systems.

Course Outcomes

1. After studied unit-1, the student will be able to describe the database architecture and its applications Sketch the ER diagram for real world applications Uses various ER diagram for a similar concept from various sources
2. After studied unit-2, the student will be able to discuss about the relational algebra and calculus Construct various queries in SQL and PL/SQL Compiles various queries in SQL, Relational Calculus and Algebra.
3. After studied unit-3, the student will be able to describe the various normalization forms apply the normalization concepts for a table of data Practices a table and implement the normalization concepts.
4. After studied unit-4, the student will be able to explain the storage and accessing of data.
5. After studied unit-5, the student will be able to illustrate the query processing in database management and to define the concurrency control and deadlock concept.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	No	No	Yes	Yes	No
4	Yes	Yes	No	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	No	No

Unit-1: DATABASE ARCHITECTURE AND ER DIAGRAM **Teaching Hours: 13 Hrs**

Database system applications - Purpose of database systems - View of data- Database languages - Database architecture - Database users and administrators - History of database systems-Entity relationship modelling: entity types, entity set, attribute and key, relationships, relation types, roles and structural constraints, weak entities, enhanced E-R and object modelling, sub classes; super classes, inheritance, specialization and generalization.

Unit-2: RELATIONAL DATA MODEL **Teaching Hours: 13 Hrs**

Relational model concepts, Relational constraints, Relational Languages: Relational Algebra, The Tuple Relational Calculus - The Domain Relational Calculus - SQL: Basic Structure-Set Operations- Aggregate Functions-Null Value-Nested Sub Queries-Views Complex Queries Modification Of Database-Joined Relations-DDL-Embedded SQL-Dynamic SQL-Other SQL Functions- -Integrity and Security.

Unit-3: DATA NORMALIZATION **Teaching Hours: 13 Hrs**

Pitfalls in relational database design – Decomposition – Functional dependencies – Normalization – First normal form – Second normal form – Third normal form – Boyce-Codd normal form – Fourth normal form – Fifth normal form.

Unit-4: STORAGE AND FILE ORGANIZATION **Teaching Hours: 13 Hrs**

Disks - RAID -Tertiary storage - Storage Access -File Organization – organization of

files - Data Dictionary storage.

Unit-5: QUERY PROCESSING AND TRANSACTION MANAGEMENT

Teaching Hours: 13 Hrs

Query Processing - Transaction Concept - Concurrency Control –Locks based protocol Deadlock Handling -Recovery Systems.

TEXTBOOKS:

1. Pranab Kumar Das Gupta and P. Radha Krishnan, "Database Management System Oracle SQL and PL/SQL", Second Edition, 2013, PHI Learning Private Limited.
2. RamezElmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Publications

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry Korth, S. Sudarshan, "Database System Concepts", Seventh Edition, TMH.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	M	S	S
CO2	S	M	S	S	S	S	M	S	M	S
CO3	S	S	M	S	S	S	S	S	S	M
CO4	S	M	S	S	M	S	S	M	M	S
CO5	S	M	S	M	S	S	M	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.C.A) - 2022-2023 onwards

Semester: IV **Paper type: Core Practical - Practical - 4**

Paper code: **Name of the Paper: RDBMS Lab** **Credit: 3**

Total Hours per Week: 4 Lecture Hours: **Tutorial Hours:** **Practical Hours: 52**

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Course Objectives

1. To understand the concepts of DDL/DML/DCL/TCL commands.
2. To understand the concepts of Join queries.
3. To understand the concepts of exception handling.
4. To understand the concepts of cursors.
5. To understand the concepts of packages.

Course Outcomes

1. Design and Implement a database schema for a given problem domain.

2 Populate and Query a database using SQL, DDL/DML Commands.

3 Build well formed in String Date/Aggregate Functions.

4 Design and Implement a database query using Joins, Sub-Queries and Set Operations.
5 Program in SQL including Objects (Functions, Procedures, and Triggers).

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	No	Yes	Yes
2	Yes	Yes	No	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	Yes
4	Yes	Yes	No	No	Yes	Yes
5	Yes	No	Yes	Yes	No	Yes

LIST OF PRACTICAL EXERCISES:

1. Execute a single line query and group functions.
2. Execute DDL Commands.
3. Execute DML Commands
4. Execute DCL and TCL Commands.
5. Implement the Nested Queries.
6. Implement Join operations in SQL
7. Create views for a particular table
8. Implement Locks for a particular table.
9. Write PL/SQL procedure for an application using exception handling.
10. Write PL/SQL procedure for an application using cursors.
11. Write a PL/SQL procedure for an application using functions
12. Write a PL/SQL procedure for an application using package.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.

d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

REFERENCE BOOK:

1.Abraham Silberschatz, Henry Korth, S. Sudarshan, Database Systems Concepts, Sixth Edition, McGraw Hill, 2010. 2. Raghu Ramakrishnan and Johannes Gehrke, Database management systems, Third Edition,2002.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	M	S
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	M	S	S	S	S	S	M	S	S
CO5	S	S	S	M	S	M	S	S	M	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.C.A) - 2022-2023 onwards

Semester: IV **Paper type: Allied II - Paper - 4**

Paper code: **Name of the Paper: Financial accounting II** **Credit: 5**

Total Hours per Week: 7 Lecture Hours: 91 Tutorial Hours: Practical Hours:

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COURSE OBJECTIVE:

1. To Understand the concept of Branch Accounting and enable the students to prepare Accounts for various types of Branches.

2, To enhance the procedure for preparing Departmental Accounts.

3. To Develop the skill of the students in preparing Hire Purchase Accounting, both in the books of H Purchaser and Hire Vendor.

4. To Understand the Accounting procedure for Partnership in cases like Admission, Retirement, Death.

5. To Understand the Accounting procedure for Dissolution and Insolvency of a Partner.

COURSEOUTCOME

On successful completion of this course, the students will be able

1	Student can able To Understand the concept of Branch Accounting and enable the studer to prepare Accounts for various types of Branches.
2	Student can be able To enhance the procedure for preparing Departmental Accounts.
3	Student can be able to Develop the skill of the students in preparing Hire Purch Accounting, both in the books of Hire Purchaser and Hire Vendor.
4	Student can able to Understand the Accounting procedure for Partnership in cases l Admission, Retirement, Death.

5 To Understand the Accounting procedure for Dissolution and Insolvency of a Partner.

Unit – I BRANCH ACCOUNTS

Branch Accounts –Objectives – Types of Branches – Debtors System (at cost price and Invoice Price) – Independent Branch.

Unit – II DEPARTMENTAL ACCOUNTS

Departmental Accounts – Objectives – Distinction between Departments and Branches – Allocation of common expenses – Expenses which cannot be allocated – Inter Department transfer at cost price and selling price.

Unit – III HIRE PURCHASE SYSTEM

Hire Purchase system – Meaning – Journal Entries and Ledger Accounts in the books of Hire Purchaser and Hire Vendor – Default and Repossession -Complete Repossession only.

Unit – IV PARTNERSHIP ACCOUNTS – I

Partnership Accounts – Admission of Partner– Retirement of Partner – Death of a Partner (Simple Problems)

Unit – V PARTNERSHIP ACCOUNTS – II

Dissolution of Partnership Firm - Insolvency of a Partner -Insolvency of all Partners (Garner vs. Murray). (Simple Problems)

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

o. Book review and research paper review, syllabus and curriculum review.
p. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
q. Workshops, preparing technical term dictionaries from text books and reference books.
r. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
s. Forming digital library: collecting text and reference books, course material.
t. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
u. Extracurricular and cultural activities may be framed through the syllabus content.
v. Grouping students for self-discussion, self-learning process.
w. Following institution and intellectual and writing reports in the course field.
x. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
y. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study.

Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.

z. Extracurricular activities may be framed through their syllabus content.

aa. Bring the industries to the campus. Bring the students to the industry.

bb. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

TEXT BOOK

S.No	Author	Title	Publisher	Year of Publication
1	T.S.Reddy and Murthy	Financial Accounting	Margham Publications	2018

REFERENCE BOOKS

S.No	Author	Title	Publisher	Year of Publication
1	M.C. Shukla and T.S. Grewal&co	Advanced Accounts	S. Chand & Co	2016
2	R.L. Gupta	Financial Accounting	Sultan chand	2014
3	S.P. Jain &K.L Narang,	Financial Accounting	Kalyani Publication	2017
4	R.S.N Pillai&V.Bagavathi	Fundamental of Advanced Accounting, Volume – I	S. Chand & Co	2013

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
((BCA) – 2022-2023 onwards

Semester: IV Paper type: Non Major Elective – Paper 2

Paper code: Name of the Paper: Internet Technology Credit: 2

Total Hours per Week: 2 Hrs. Lecture Hours: 26 Hrs. Tutorial

Hours:.. Practical Hours: …..

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Course Objectives

1. Aims to build the concepts regarding Fundamentals of Internet, Connectivity and its Resource Requirements.
2. To understand the Internet Technology and its applications
3. To Understand WWW and Web Browsers.
4. To Understand Mailing system and applications of Internet.
5. To Understand relay chat

Course Outcomes

1. After studied unit-1, the student will be able to understand the Fundamentals of Internet, Connectivity and its Resource Requirements.

2. After studied unit-2, the student will be able to understand the Internet Technology and its applications

3. After studied unit-3, the student will be able to understand the basis of WWW and Web Browsers.

4. After studied unit-4, the student will be able to learn how to Mailing system and applications of Internet.
5. After studied unit-5, the student will be able to Understand relay chat that is how to read e- contents.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO INTERNET: **Teaching Hours: 5 Hrs.**

What is Internet? Evolution and History of Internet- Growth of Internet-Owners of Internet- Internet Services- How does the Internet Works?-Anatomy of Internet-Internet Addressing-Internet vs Intranet-Impact of Internet- Governance of Internet.

Unit-2: INTERNET TECHNOLOGY AND PROTOCOL: Teaching Hours: 5 Hrs.

ISO-OSI Reference Model-**Internet Connectivity:** Getting Connected- Different Types of Connections- Levels of Internet Connectivity- Internet Service Provider. **Internet Tools and Multimedia:** Current Trends on Internet-Multimedia and Animation.

Unit-3: WWW AND WEB BROWSER: Teaching Hours: 5 Hrs.

WWW-Evolution of Web-Basic Elements of WWW-Web Browsers-Search Engines- Search Criteria. **Web Publishing:** Web Publishing- Web Page Design.

Unit-4: EMAIL: Teaching Hours: 5 Hrs.

E-Mail Basics- E-Mail System-E-Mail Protocol-E-Mail Addresses-Structure of an E- Mail Message-E-Mail Clients& Servers-Mailing List-E-Mail Security.

Unit-5: **USENET AND INTERNET RELAY CHAT: Teaching Hours: 6 Hrs.**

What is Usenet?-Newsgroup Hierarchies-What is a Newsreader?-How do you Read Newsgroups?- Who Administers Usenet?- Common News reading Tasks- How to Read Articles from Network News?-Relationship between Netnews and E-Mail-What is IRC?-Channels-Nicknames- Microsoft NetMeeting. **Internet and Web Security**: Overview of Internet Security-Aspects and Need of Security-E-Mail Threats and Secure E-mail-Web Security and Privacy Concepts-Firewall.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.

f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. ISRD Group. 2012. **Internet Technology and Web Design.** [Fourth reprint]. Tata McGraw-Hill Education Private Limited., New Delhi.

Reference Books:

1. Deitel,H.M

Dietel,P.J.andGoldbergA.B.2008.**Internet&W orldwide Web- How toProgram.**[Third Edition].PHL,New Delhi.

2. Comdex2000.**Teachyourselfcomputersandthein ternetvisually**.[First Edition]. IDGBookIndia (p)Ltd.

2. Ramachandran,T.M.Nambissan.2003.**AnOverviewofinternetandweb development**. [FirstEdition].T M-Dhruv Publications.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	M	M	M	S	S	S	S	S
CO3	S	M	M	S	S	M	S	S	S	S
CO4	S	S	M	S	S	S	S	S	M	S
CO5	S	S	M	M	M	S	M	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Core Theory** **Paper 9**

Paper code: **Name of the Paper: Mobile Application Development**
Credit: 4

Total Hours per Week: 6 **Lecture Hours: 78 .** **Tutorial Hours:** **Practical Hours:**

……

Course Objectives

1. To understand the basics concept of mobile applications

2. To understand the structure of mobile applications

3. To understand simple mobile applications

4. To understand the mobile application services

5. To understand the real life mobile application development.

Course OutComes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the basics of smart phones and android platforms**.**

2. After studied unit-2, the student will be able to understand the basic concepts of user interface related to app development.

3. After studied unit-3, the student will be able to understand the important of data persistence in mobile environment.

4. After studied unit-4, the student will be able to understand the various services and network facilities provided by android platform.

5. After studied unit-5, the student will be able to understand the various apps deployed and developed on by mobile platform.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION **Teaching Hours: 16 Hrs.**

Introduction to Mobile Application Development – Various platforms– Smartphones– Android platform: features – Architecture – Versions–ART(Android Runtime)–ADB(Android Debug Bridge) –Development environment/IDE: Android studio and its working environment – Emulator setup –Application framework basics–XML representation and Android manifest file –Creating a simple application.

Unit-2: GUI
Teaching Hours: 15 Hrs.

GUI for Android: activities lifecycle–Android v7 support library –Intent: Intent object – Intent filters– Adding categories – Linking activities – User Interface design components– Basic Views – Picker Views – List View –Specialized Fragment– Gallery and Image View – Image Switcher – Grid View, Options Menu – Context Menu – Clock View –Web view– Recycler View.

Unit-3:DATA PERSISTENCE SCHEMES
Teaching Hours: 12 Hrs.

Different Data Persistence schemes: Shared preferences–File Handling–Managing data using SQLite database –Content providers: user content provider– Android in build content providers.

Unit-4: SERVICES **Teaching Hours: 19 Hrs.**

Services: Introduction to services – Local service – Remote service – Binding the service –Communication between service and activity –Intent Service – Multi–Threading: Handlers – Async Task– Android network programming: Http Url Connection– Connecting to REST–based –SOAP based Web services –Broad cast receivers: Local Broadcast Manager– Dynamic broadcast receiver – System Broadcast –Telephony Manager: Sending SMS and making calls.

Unit-5: LOCATION BASED SERVICES
Teaching Hours: 16 Hrs.

Location based services: Google maps V2 services using Google API–Animations and Graphics: Property Animation –View Animations –Drawable Animations –Media and Camera API: Working with video and audio inputs – camera API –Sensor programming: Motion sensors–Position sensors– Environmental sensors –Publishing Android Apps: Guide lines– policies and process of uploading Apps to Google play.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

cc. Book review and research paper review, syllabus and curriculum review.
dd. Data collection and paper writing practices: books level, field study level. Using the course study for
ee. society and nature development – exercise
ff. Workshops, preparing technical term dictionars from text books and reference books.
gg. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
hh. Forming digital library: collecting text and reference books, course material.
ii. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
jj. Extracurricular and cultural activities may be framed through the syllabus content.
kk. Grouping students for self-discussion, self-learning process.
ll. Following institution and intellectual and writing reports in the course field.
mm. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
nn. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
oo. Extracurricular activities may be framed through their syllabus content.
pp. Bring the industries to the campus. Bring the students to the industry.
qq. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. "Head First: Android Development", Dawn Griffiths, David Griffiths, OReilly, 1st Edition, 2015.
2. Barry Burd, "Android Application Development – All–in–one for Dummies", 2nd Edition,Wiley India, 2016.

Reference Book:

1. "Professional Android™ Sensor Programming",Greg Milette,Adam Stroud, John Wiley and Sons, Inc2012.
2. "Android 6 for Programmers, App Driven approach", Paul Deital, Harvey Deital, Alexander Wald, Prentice Hall, 2015.

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	S	S	L	M
CO2	S	S	M	M	S	M	S	S	L	M
CO3	S	S	S	S	M	S	S	M	M	S
CO4	S	S	S	L	S	S	S	M	S	S
CO5	M	S	M	M	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Core Theory Paper - 10**

Paper code: **Name of the Paper: Operating System** **Credit: 4**

Total Hours per Week: 6 **Lecture Hours: 78 .** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To understand the structure and functions of operating systems.

2. To understand the principles of scheduler, scheduler algorithms and Deadlock.

3. To learn various memory management schemes.

4. To understand the memory management services

5. To study I/O management, File system and Mass Storage Structure.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the basics of smart phones and android platforms**.**

2. After studied unit-2, the student will be able to understand the basic concepts of user interface related to app development.

3. After studied unit-3, the student will be able to understand the important of data persistence in mobile environment.

4. After studied unit-4, the student will be able to understand the various services and network facilities provided by android platform.

5. After studied unit-5, the student will be able to understand the various apps deployed and developed on by mobile platform.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION **Teaching Hours: 16 Hrs.**

Basic Concepts of Operating System – Services of Operating System – Operating System Types – Computer System Operation – I/O Structure – Storage Structure – Memory Hierarchy – System Components – System Calls – System Programs – System Design and Implementation – Introduction to Process – Process State – Process Control Block – Process Scheduling – Operations on Process – Interprocess Communication – Communication in Client/Server Systems – Threads .

Unit-2: CPU SCHDULER **Teaching Hours: 15 Hrs.**

Types of CPU Scheduler – Scheduling Criteria – Scheduling Algorithms – Semaphores – Classic Problems of Synchronization – Basic Concept of Deadlocks – Deadlock Characterization – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery of Deadlock.

Unit-3: MEMORY MANAGEMENT **Teaching Hours: 12 Hrs.**

Memory Management – Basics Concept of Memory – Address Binding – Logical and Physical Address Space – Memory Partitioning – Memory Allocation – Paging – Segmentation – Segmentation and Paging – Protection – Fragmentation – Compaction – Demand Paging – Page Replacement Algorithm – Classification of Page Replacement Algorithm .

Unit-4: FILE SYSTEM **Teaching Hours: 19 Hrs.**

File System Storage – File Concept– File Access Methods – Directory Structure – File Sharing – File Protection – File System Implementation – File System Structure – Allocation Methods – Free Space Management – Mass Storage Structure – Disk structure – Disk Scheduling and Management – RAID Levels.

Unit-5: UNIX SYSTEM **Teaching Hours: 16 Hrs.**

UNIX System – A Case Study – LINUX System – Case Study – Design Principles – Process Management – Scheduling – Memory Management – File Systems – Security .

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.

b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. "Operating System Concepts" –Abraham Silberschatz Peter B. Galvin, G. Gagne, Sixth Edition, Addison Wesley Publishing Co., 2003.
2. "Operating System" – Willam Stalling, Fourth Edition, Pearson Education, 2003.

Reference Book:

1. "Operating systems – Internals and Design Principles", W. Stallings, 6th Edition, Pearson.
2. "Modern Operating Systems", Andrew S.Tanenbaum, Second Edition Addison Wesley, 2001.
3. "Fundamentals of Operating System", Prof. R. Sriddhar, Dynaram Publication, Bangalore Company.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	S	S	L	M
CO2	S	S	M	M	S	M	S	S	M	L
CO3	S	S	S	S	M	S	S	M	M	S
CO4	S	S	S	L	S	S	S	S	S	S
CO5	M	S	M	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Core Theory Paper - 11**

Paper code: **Name of the Paper: Design and Analysis of Algorithms** **Credit: 2**

Total Hours per Week: 4 **Lecture Hours: 52.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To learn about the basics various algorithms.

2. To understand the fundamentals of divide and conquer techniques.

3. To understand the basic algorithms that using greedy methods.

4. To apply the concept of traversal and searching algorithms.

5. To understand the concept of backtracking methods.

Course Outcomes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to Understanding various algorithm design techniques.

2. After studied unit-2, the student will be able to understand the basis of efficient algorithms for all kinds of problems**.**

3. After studied unit-3, the student will be able to use simple approach which tries to find the best solution at every step.

4. After studied unit-4, the student will be able to providing a general insight into the dynamic programming approach.

5. After studied unit-5, the student will be able to understand the algorithm design paradigm for discrete and combinatorial optimization problems.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO DATA STRUCTURE

Teaching Hours: 10 Hrs,

Elementary Data Structures: Stack – Queues – Trees – Priority Queue – Graphs – What is an Algorithm? – Algorithm Specification – Performance Analysis: Space Complexity – Time Complexity – Asymptotic Notation – Randomized Algorithms.

Unit-2: SEARCH AND SORTING **Teaching Hours: 11 Hrs.**

General Method – Binary Search – Recurrence Equation for Divide and Conquer – Finding the Maximum and Minimum— Merge Sort – Quick Sort – Performance Measurement – Randomized Sorting Algorithm – Selection Sort – A Worst Case Optimal Algorithm – Implementation of Select2 – Stassen's Matrix Multiplications.

Unit-3: TREES **Teaching Hours: 11 Hrs.**

The General Method – Container Loading – Knapsack Problem – Tree Vertex Splitting – Job Sequencing with Deadlines – Minimum Cost Spanning Trees – Prim's Algorithm – Kruskal's Algorithm – An optimal Randomized Algorithm – Optimal Storage on Tapes – Optimal Merge Pattern – Single Source Shortest Paths.

Unit-4: GRAPHS **Teaching Hours: 10 Hrs.**

The General Method – Multistage Graphs – All Pair Shortest Path – Optimal Binary Search Trees – String Editing – 0/1 Knapsack – Reliability Design – The Traveling Salesperson Problem. Techniques for Binary Trees – Techniques for Graphs – BFS – DFS.

Unit-5: PROBLEM SOLVING METHODS

Teaching Hours: 10 Hrs.

The General Method – The 8– Queens Problem – Sum of Subsets– Graph Coloring – Hamiltonian Cycles – Branch and Bound: General Method – LC Branch and Bound – FIFO Branch and Bound.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. "Fundamentals of Computer Algorithms", Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Galgotia Publications, Second Edition 2015.
2. "Introduction to Algorithms", Coremen T.H., Leiserson C.E. and Rivest R.L., PHI Publications, Third Edition, 1998.

Reference Book:

1. "Introduction to the Design and Analysis of Algorithms", AnanyLevitin, Pearson Education, 2nd Edition.
2. "Introduction to Algorithms" Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Prentice Hall of India, New Delhi, Second Edition, 2007.
3. "Computer Algorithms – Introduction to Design & Analysis" Sara Baase and Allen Van Gelder, Pearson Education New Delhi, Third Edition, 2000.

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	L	M

CO2	S	S	M	M	S	M	S	S	M	L
CO3	M	S	S	S	M	S	M	S	M	S
CO4	S	S	S	L	M	S	S	S	S	S
CO5	S	S	M	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Core Practical - Practical - 5**

Paper code: **Name of the Paper: Mobile Application Development Lab**
Credit: 3

Total Hours per Week: 4 **Lecture Hours:** **Tutorial Hours: …..** **Practical Hours: 52**

……..……
……

Course Objectives

1. To learn about the basics of developing android applications.
2. To understand the usage of the controls in android application.
3. To understand the advanced controls that are used in android applications.
4. To understand how the alerts are worked in application.
5. To understand the concept of connecting a database into the application.

Course Outcomes:

1, Able to understand about the basic developments of android applications
2. Able to understand the usage of the controls in android application.
3. Able to understand the advanced controls that are used in android applications.
4. Able to understand how the alerts are worked in application.
5. Able Tt understand the concept of connecting a database into the application.

List of Practical Exercises:

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Intent and Activity.
3. Develop an application that uses Layout Managers and event listeners.
4. Develop an application that draws basic graphical primitives on the screen.

5. Develop an application that makes use of RSS Feed.
6. Develop an application that implements Multithreading.
7. Develop an application that create alarm clock.
8. Develop an application Using Widgets.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Develop an application that makes use of database.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
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l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Course Material: website links, e-Books and e-journals

1. www.tutorialpoint.com
2. www.developer.android.com
3. www.toptal.com

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	L	M
CO2	S	S	M	M	S	M	S	S	M	L
CO3	M	S	S	S	S	S	M	S	M	S
CO4	S	S	M	L	S	S	S	S	S	M
CO5	S	S	M	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Core Practical - Practical - 6**

Paper code: **Name of the Paper: Operating System Lab** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours:** **Tutorial Hours: …..** **Practical Hours: 52**

……

Course Objectives

1. To learn about the basics of UNIX commands and shell programming.

2. To understand the programming knowledge of scheduling algorithms.

3. To understand the working of semaphores in operating system.

4. To understand how to code various algorithm used in operating system.

5. To understand how to code and working procedure of file management concepts in operating system.

Course Outcomes:

1. Able to understand the basics of UNIX commands and shell programming.

2. Able to understand the programming knowledge of scheduling algorithms.

3. Able to understand the working of semaphores in operating system.

4. Able to understand how to code various algorithm used in operating system.

5. Able to understand how to code and working procedure of file management concepts in operating system.

List of Practical Exercises:

1. Basics of UNIX commands.
2. Shell Programming.
3. Implement the following CPU scheduling algorithms

   a) Round Robin b) SJF c) FCFS d) Priority

4. Implement all file allocation strategies

   a) Sequential b) Indexed c) Linked

5. Implement Semaphores
6. Implement all File Organization Techniques

   a) Single level directory b) Two level c) Hierarchical d) DAG

7. Implement Bankers Algorithm for Dead Lock Avoidance
8. Implement an Algorithm for Dead Lock Detection
9. Implement e all page replacement algorithms

   a) FIFO b) LRU c) LFU

10. Implement Shared memory and IPC
11. Implement Paging Technique of memory management.
12. Implement Threading & Synchronization Applications.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study.

Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.

l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Course Material: website links, e-Books and e-journals

1. www.tutorialpoint.com
2. www.javapoint.com
3. www.w3school.com

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	L	M
CO2	S	S	M	M	S	M	S	S	M	L
CO3	M	S	S	S	S	S	M	S	M	S
CO4	S	S	M	L	S	S	S	S	S	M
CO5	S	S	M	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V Paper type: Internal Elective 1 Paper-1

Paper code: Name of the Paper: Data Mining
Credit: 3

Total Hours per Week: 3 Lecture Hours: 39 . Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To learn about the basics of data and data mining concepts.

2. To understand the fundamentals of analytical and data warehousing concepts

3. To understand the techniques that are followed in data mining.

4. To understand the basics of outlier detection and clustering concepts

5. To understand the tools that are used in data mining.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand about the basics of data mining and data.

2. After studied unit-2, the student will be able to understand about the methods of Data Warehousing

3. After studied unit-3, the student will be able to understand about the techniques of Data Mining

4. After studied unit-4, the student will be able to understand about the importance of Cluster and outlier detection

5. After studied unit-5, the student will be able to improve the student's knowledge with recent trends and tools

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes

2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	No	No
5	Yes	Yes	Yes	No	Yes	Yes

Unit-1: INTRODUCTION **Teaching Hours: 8 Hrs.**

What is Data Mining– Kinds of Data – Kinds of patterns – Technologies used for Data Mining– Major Issues in Data Mining– Data –Data Objects and Attribute types– Data Visualization– Measuring Data Similarity and Dissimilarity–Data Preprocessing– overview– Data Cleaning– Data Integration– Data Reduction– Data Transformation and Data Discretization?

Unit-2: CONCEPTS OF DATA WARHOUSE

Teaching Hours: 7 Hrs.

Data Warehouse– Basic concepts–Data Warehouse Modelling: Data Cube and OLAP– Data Warehouse Design and Usage– Data Warehouse Implementation– Data Generalization by Attribute–Oriented Induction– Data Cube Technology– Data Cube Computation Methods– Exploring Cube Technology–Multidimensional Data Analysis in cube space.

Unit-3: CONCEPTS OF PATTERN

Teaching Hours: 9 Hrs.

Patterns– Basic concepts– Pattern Evaluation Methods–Pattern Mining: Pattern Mining in Multilevel– Multidimensional space–Constraint–Based Frequent Pattern Mining– Mining High Dimensional Data and Colossal patterns– Mining compressed or Approximate patterns– Pattern Exploration and Application. Classification–Decision tree Induction– Bayes Classification methods– Rule based Classification– Model Evaluation and selection– Techniques to Improve Classification Accuracy– Other Classification methods.

Unit-4: CLUSTERS **Teaching Hours: 8 Hrs.**

Cluster Analysis– Partitioning Methods – Hierarchical Methods – Density – Based Methods– Grid – Based Methods – Evaluation of Clustering.– Clustering High – Dimensional Data–Clustering Graph and Network Data – Clustering with Constraints – Web Mining – Spatial Mining. Outlier Detection – Outliers and Outliers Analysis – Outlier Detection Methods–Outlier Approaches – Statistical – Proximity–Based – Clustering–Based– Classification Based – High–Dimensional Data.

Unit-5: DATA MININ METHODOLOGIES

Teaching Hours: 7 Hrs.

Other Methodologies of Data Mining – Data Mining Applications – Data Mining Trends – Recent Data Mining Tools – Rapid miner – Orange – Weka–Knime–Sisense –Ssdt (SQL Server Data Tools) – Oracle – Rattle – Data melt – Apache Mahout.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. "Data Warehousing Fundamentals", PaulrajPonnaiah, Wiley Publishers, 2001.
2. "Data Mining: Concepts and Techniques", Jiawei Han, MichelineKamber, Morgan Kaufman Publishers, 2006.
3. "Introduction to Data mining with case studies", G.K. Gupta, PHI Private limited, New Delhi, 2008. 2nd Edition, PHI, 2011

Reference Book:

1. "Advances in Knowledge Discover and Data Mining", Usama M. Fayyad, Gregory Piatetsky Shapiro, Padhrai Smyth RamasamyUthurusamy, the M.I.T. Press, 2007.
2. "The Data Warehouse Toolkit", Ralph Kimball, Margy Ross, John Wiley and Sons Inc., 2002
3. "Building Data Mining Applications for CRM", Alex Berson, Stephen Smith, Kurt Thearling, Tata McGraw Hill, 2000.

4. "Data Mining: Introductory and Advanced Topics", Margaret Dunham, Prentice Hall, 2002.
5. "Discovering Knowledge in Data: An Introduction to Data Mining", Daniel T. Larose John Wiley & Sons, Hoboken, New Jersey, 2004

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	L	M
CO2	S	S	M	M	S	M	S	S	M	L
CO3	M	S	S	S	S	S	M	S	M	S
CO4	S	S	S	L	S	S	S	S	S	S
CO5	S	S	M	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Internal Elective 1** **Paper - 1**

Paper code: **Name of the Paper: Information Security** **Credit: 3**

Total Hours per Week: 3 **Lecture Hours: 39 .** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To learn about the basics of information security.

2. To understand the fundamentals of information security.

3. To understand the risk management techniques.

4. To understand the current techniques that are used in information security.

5. To understand the concept of networking concept and techniques.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the basic concepts of Information Security

2. After studied unit-2, the student will be able to understand the legal, ethical and professional issues in Information Security

3. After studied unit-3, the student will be able to know about risk management

4. After studied unit-4, the student will be able to understand the technological aspects of Information Security

5. After studied unit-5, the student will be able to understand the concepts of Cryptography and Hacking methods

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	Yes
2	Yes	No	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	No	Yes

Unit-1: INFORMATION SECURITY BASICS **Teaching Hours: 6 Hrs.**

Introduction –History – What is Information Security? – Critical Characteristics of Information – NSTISSC Security Model – Components of an Information System – Securing the Components – Balancing Security and Access – The SDLC – The Security SDLC.

Unit-2: SECURITY INVESTIGATION **Teaching Hours: 7 Hrs.**

Security – Business Needs – Threats – Attacks – Legal – Ethical and Professional Issues – Relevant U.S. Laws – International Laws and Legal Bodies – Ethics and Information Security – Codes of Ethics and Professional Organizations

Unit-3: SECURITY ANALYSIS **Teaching Hours: 9 Hrs.**

Risk Management – Introduction – An Overview of Risk Management – Risk Identification – Risk Assessment – Risk Control Strategies – Selecting a Risk Control Strategy –Quantitative versus Qualitative Risk Control Practices – Risk Management Discussion Points

Unit-4: SECURITY MODELS **Teaching Hours: 10 Hrs.**

Logical Design – Blueprint for Security – Information Security Policy – Standards and Practices– ISO 17799/BS 7799– NIST Models– VISA International Security Model – Design of Security Architecture – Planning for Continuity – Security Physical Design –Firewalls – Security Technology – IDS – IPS – Honey Pots – Honey Nets – Padded cell Systems Scanning and Analysis Tools – Access Control Devices.

Unit-5:CRYPTOGRAPHY AND ETHICAL HACKING
Teaching Hours: 7 Hrs.

Cipher methods – Cryptographic Algorithms and Tools – Attacks on Cryptosystems– Hacking – Effects of Hacking – Hacker – Types of Hacker– Ethical Hacker –Hacktivism– Networking & Computer Attacks – Malicious Software (Malware) – Protection Against Malware – Intruder Attacks on Networks and Computers – Wireless Hacking– Windows Hacking – Linux Hacking Session.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

o. Book review and research paper review, syllabus and curriculum review.
p. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
q. Workshops, preparing technical term dictionaries from text books and reference books.
r. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
s. Forming digital library: collecting text and reference books, course material.
t. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
u. Extracurricular and cultural activities may be framed through the syllabus content.
v. Grouping students for self-discussion, self-learning process.
w. Following institution and intellectual and writing reports in the course field.
x. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
y. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
z. Extracurricular activities may be framed through their syllabus content.
aa. Bring the industries to the campus. Bring the students to the industry.
bb. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. "Principles of Information Security", Michael E Whitman and Herbert J Mattord, 5th Edition, Vikas Publishing House, New Delhi, 2003.
2. "Fundamentals of Information Systems Security", David Kim,MichaelG.Solomon, 3rd Edition ,Jones & Bartlett Learning, October 2016.
3. "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Patrick Engebretson, 2nd Edition, Syngress Basics Series – Elsevier, 2011.
4. "Hands-On Ethical Hacking and Network Defense", Michael T. Simpson, Kent Backman, James E. Corley, Second Edition, CENGAGE Learning, 2010.

Reference Book:

1. "Handbook of Information Security Management", Micki Krause, Harold F. Tipton, sixth Edition, CRC Press LLC, 2004.
2. "Hacking Exposed", Stuart McClure, Joel Scrambray, George Kurtz, Tata McGraw–Hill, 2003.
3. "Computer Security Art and Science", Matt Bishop, 2ndEdition , Pearson/PHI, 2002.

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	L	M
CO2	S	S	M	M	S	M	S	S	M	L
CO3	M	S	S	S	S	S	M	S	M	S
CO4	S	S	M	L	S	S	S	S	S	M
CO5	S	S	M	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Internal Elective 1 Paper - 1**

Paper code: **Name of the Paper: Software Testing** **Credit: 3**

Total Hours per Week: 3 **Lecture Hours: 39 .** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To understand about the basics of software testing.

2. To understand the fundamentals of software development models.

3. To understand the structural testing methods.

4. To understand the current techniques that are used in object oriented testing models.

5. To understand the concept of software testing quality details.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the concept of software testing, and software quality

2. After studied unit-2, the student will be able to learn to inspect and detect errors by going through each and every code segment

3. After studied unit-3, the student will be able to gain knowledge of various functional and structural testing techniques

4. After studied unit-4, the student will be able to understand basic concept of Software Management tools and object oriented testing

5. After studied unit-5, the student will be able to understand basic concept of Software quality and software quality assurance

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No

5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO SOFTWARE TESTING **Teaching Hours: 6 Hrs.**

Fundamentals of software testing – need for software testing– Psychology of testing – various approaches – characteristics of testing – principles of testing – testing strategies – verification and validation – Defect and Prevention strategies.

Unit-2: SOFTWARE DEVELOPMENT MODEL AND TESTING
Teaching Hours: 7 Hrs.

Water fall model– V–model– Spiral model– Agile model – Life cycle of testing– Static Testing – dynamic testing – White box testing – Block box testing – Regression testing – Integration Testing – System and Performance Testing – Usability Testing

Unit-3: FUNCTIONAL AND STRUCTURAL TESTING **Teaching Hours: 9 Hrs.**

Boundary Value Analysis – Equivalence Class Testing – Decision Table – Based Testing – Cause Effect Graphing Technique – Path testing –Cyclomatic Complexity – Graph Metrics – Data Flow Testing – Slice based testing

Unit-4: TEST MANAGEMENT AND TOOLS **Teaching Hours: 10 Hrs.**

Test planning – cost–benefit analysis of testing – monitoring and control– test reporting – test control – Specialized testing – Object Oriented Testing – Automated Tools for Testing – Tool Selection and Implementation – Challenges in test automation– GUI Testing

Unit-5:SOFTWARE QUALITY AND SOFTWARE QUALITY ASSURANCE
Teaching Hours: 7 Hrs.

Introduction to software quality and software quality assurance – basic principles about the software quality and software quality assurance – Planning for SQA – various models for software product quality and process quality – SCM – RAD – System Documentation

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise

c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. "Software Testing– A Craftsman's Approach" – Paul C. Jorgensen – Second Edition – CRC Press 2008
2. "Software Testing", – Ron Patton, Second Edition –Sams Publishing, Pearson Education, 2007.
3. "Software Testing– A Craftsman's Approach" – Paul C. Jorgensen, Second Edition – CRC Press, 2008

Reference Books:

1. "Software Testing and Analysis: Process, Principles and Techniques" – Mauro Pezze, Michal Young – Wiley India , 2008
2. "Software Engineering" – K.K. Aggarwal&Yogesh Singh – New Age International Publishers – New Delhi, 2003.
3. "Software Testing – Principles and Practices" –SrinivasanDesikan and Gopalaswamy Ramesh, Pearson Education, 2006.

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	M	S	S	L	M
CO2	S	S	M	M	S	M	S	S	M	S

CO3	M	S	S	S	S	S	M	S	S	S
CO4	S	S	S	L	S	S	S	S	S	M
CO5	S	S	S	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: V **Paper type: Skill Based Subject III** **Paper - 3**

Paper code: **Name of the Paper: Software Engineering** **Credit: 2**

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

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Course Objectives

1. To understand about the basic method to develop a software.

2. To understand the fundamentals for choosing requirements of the project.

3. To understand the concept of software engineering.

4. To understand the methods involve in software testing.

5. To understand the basic knowledge in software project management.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to the concepts and methods required for the construction of large software intensive systems.

2. After studied unit-2, the student will be able to Gets the idea of choosing the Requirements in Software Engineering.

3. After studied unit-3, the student will be able to Gives an understanding the concept of Data Engineering.

4. After studied unit-4, the student will be able to impart knowledge on Testing and Debugging.

5. After studied unit-5, the student will be able to enable the students to learn the basic of Project Management & Scheduling.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO EVOLVING SOFTWARE Teaching Hours: 6 Hrs.

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Evolving Role of Software – Nature of Software – Software Engineering – The Software Process– Software Engineering Practices – Software Myths – A Generic View of Process Model – Process Assessment and Improvement – Process Models : Waterfall Model – Incremental Process Models – Evolutionary Process Models – Concurrent Models.

Unit-2: REQUIREMENTS ENGINEERING Teaching Hours: 7 Hrs.

Requirements Engineering: Establishing the Groundwork – Initiating the Requirements Engineering Process – Eliciting Requirements – Collaborative Requirements Gathering – Quality Function Deployment – Usage Scenarios – Elicitation work Products – Building the Requirements Model – Elements of Requirements Model – Analysis Pattern – Requirements Analysis – Data Modeling Concepts.

Unit-3: DATA ENGINEERING
Teaching Hours: 9 Hrs.

Data Engineering: Design Process and Design Quality – Design Concepts – The Design Model - Creating an Architectural Design – Software Architecture – Data Design – Architectural style – Architectural Design – Architectural Mapping Using Data Flow – Performing User Interface Design – Golden Rules.

Unit-4: TESTING STRATEGIES Teaching Hours: 10 Hrs;

Testing Strategies: Strategic Approach to Software Testing – Strategic Issues – Test Strategies for Conventional and Object Oriented Software – Validation Testing – System Testing – Art of Debugging. Software Testing Fundamentals – White Box Testing – Basis Path Testing – Control Structure Testing – Black Box Testing – Model Based Testing.

Unit-5:PROJECT MANAGEMENT
Teaching Hours: 7 Hrs.

Project Management: Management Spectrum – People – Product – Process – Project – Critical Practices – Estimation: Project Planning Process – Software Scope and Feasibility – Resources – Software Project Estimation – Project Scheduling – Quality Concepts – Software Quality Assurance – Elements of Software Quality Assurance – Formal Technical Reviews.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. ”Software Engineering – A Practitioner’s Approach”, Roger S Pressman, McGraw Hill International Edition, New York: 2005, Seventh Edition.
2. ” Software Engineering”, Mall Rajib, PHI Learning, 2009, 3 Third Edition.

Reference Book:

1. “Software Engineering”, Ian Somerville, Pearson Education, 2006, 7th Edition.
2. “Software Engineering Concepts” Richard Fairley, Tata McGraw–Hill Education, 2011.
3. “Software Engineering: Theory and Practice “, Pfleeger and Lawrence, Pearson Education, 2001, Second Edition.

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	M	S	S	L	M
CO2	M	M	M	M	S	M	S	S	M	S
CO3	M	S	S	S	S	M	M	S	S	S
CO4	S	S	S	L	S	S	S	S	S	M
CO5	S	M	S	M	S	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Core Theory Paper - 12**

Paper code: **Name of the Paper: Open Source Software** **Credit: 4**

Total Hours per Week: 4 **Lecture Hours: 52.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To understand about use pre-existing code to improve the software and even come up with their own innovations.

2. To understand the fundamentals of LINUX operating system.

3. To understand the concept of scripting code for a website.

4. To understand the fundamentals of PHP language combined with HTML.

5. To understand the fundamentals of PERL languages.

Course OutComes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the concept of HTML, HTML5 and CSS.

2. After studied unit-2, the student will be able to learn to inspect and detect errors by going through each and every code segment.

3. After studied unit-3, the student will be able to understand basic concept of Java Script and MySQL.

4. After studied unit-4, the student will be able to understand basic concept of PHP

5. After studied unit-5, the student will be able to understand basic concept of PERL

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO HTML, CSS **Teaching Hours: 10 Hrs.**

Need of Open Source –Advantages of Open source –Application of Open Source – HTML – HTML tags –Dynamic Web content– HTTP Request and Response Procedure– Introduction to HTML5– HTML5 Canvas – HTML5 Audio and Video–Introduction to CSS– CSS Rules–Style Types–CSS Selectors– CSS Colors.

Unit-2: LINUX **Teaching Hours: 11 Hrs.**

Introduction: Linux Essential Commands – Kernel Mode and user mode –File system Concept – Standard Files – The Linux Security Model – Vi Editor – Partitions Creation – Shell Introduction – String Processing – Investigation and Managing Processes – Network Clients – Installing Application.

Unit-3: JAVA SCRIPT AND MYSQL **Teaching Hours: 10 Hrs.**

Java script :Advantages of JavaScript –JavaScript Syntax–Data type– Variable– Array – Operators and Expressions– Loops – functions – Dialog box– MySQL – The show Databases and Table – The USE command –Create Database and Tables – Describe Table – Select, Insert, Update, and Delete statement.

Unit-4: PHP **Teaching Hours: 11 Hrs.**

PHP Introduction – General Syntactic Characteristics – PHP Scripting – Commenting your code – Primitives, Operations and Expressions – PHP Variables – Operations and Expressions Control Statement – Array – Functions – Basic Form Processing – File and Folder Access – Cooking – Sessions – Database Access with PHO.

Unit-5:PERL **Teaching Hours: 10 Hrs.**

PERL : Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and Control structures – Subroutines, Packages, and Modules– Working with Files – Data Manipulation.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.

b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. "The Complete Reference Linux", Peterson, Tata McGraw HILL–2010
2. "Perl: The Complete Reference", Martin C. Brown, Tata McGraw Hill Publishing Company Limited, Indian Reprint 2009.
3. "MYSQL: The Complete Reference", VikramVaswani, 2nd Edition, Tata McGrawHill Publishing Company Limited, Indian Reprint 2009
4. "PHP: The Complete Reference", Steven Holzner, 2nd Edition, Tata McGrawHill Publishing Company Limited, Indian Reprint 2009.
5. "Complete Reference HTML", T. A. Powell, 3rd Edition, Tata McGrawHill Publishing Company Limited, Indian Reprint 2002.
6. "Mastering Java script" –J. Jaworski, BPB Publications, 1999

Reference Books:

1. "Fundamentals of Open Source Software", by M.N. Rao, PHI publishers.
2. "MySQL Bible", Steve Suchring, John Wiley, 2002
3. "The Linux Kernel Book", Remy Card, Eric Dumas and Frank Mevel, Wiley Publications, 2003
4. Ivan Byross, HTML, DHTML, Javascript, Perl, BPB Publication

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	M	S	S	L	M
CO2	M	M	M	M	S	M	S	S	M	S
CO3	M	S	S	S	S	M	M	S	S	S
CO4	S	S	S	L	S	S	S	S	S	M
CO5	S	M	S	M	S	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Core Theory** **Paper - 13**

Paper code: CCA51 **Name of the Paper: PYTHON Programming**
Credit: 4

Total Hours per Week: 4 **Lecture Hours: 52.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To understand the basic building blocks for PYTHON programming.

2. Build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions

3. Work with user input to create fun and interactive programs

4. To acquire Object Oriented Skills in Python

5. To develop the skill of designing Graphical user Interfaces in Python

Course OutComes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the basic building blocks for creating PYTHON programming in details.

2. After studied unit-2, the student will be able to understand the control statements and basic methods used in PYTHON programming

3. After studied unit-3, the student will be able to understand the basic build in functions.

4. After studied unit-4, the student will be able to understand the some advanced methods to use in PYTHON

5. After studied unit-5, the student will be able to understand the concept of objects used in PYTHON

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION

Teaching Hours: 6 Hrs.

Identifiers – Keywords - Statements and Expressions – Variables – Operators – Arithmetic operators – Assignment operators – Comparison operators – Logical operators – Bitwise operators - Precedence and Associativity – Data types - Number – Booleans – Strings - Indentation – Comments – Single line comment – Multiline comments - Reading Input – Print Output – Type Conversions – int function – float function – str() function – chr() function – complex() function – ord() function – hex() function – oct() function - type() function and Is operator – Dynamic and Strongly typed language.

Unit-2: CONTROL FLOW STATEMENTS

Teaching Hours: 7 Hrs.

Control Flow Statements – If statement – If else statement – If elif else statement – nested if statement - while loop – for loop – continue and break statements – catching exceptions using try and except statement – syntax errors – exceptions – exception handling – Strings – str() function - Basic string operations – String comparison – Built in functions using strings – Accessing characters in string – String slicing – String joining – split() method – string traversing.

Unit-3: FUNTIONS

Teaching Hours: 9 Hrs.

Functions – Built in functions – function definition and calling - return statement – void function – scope and lifetime of variables – args and kwargs – command line arguments - Tuples – creation – basic tuple operations – tuple() function – indexing – slicing – built-in functions used on tuples – tuple methods – packing – unpacking – traversing of tuples – populating tuples – zip() function - Sets – Traversing of sets – set methods – frozenset.

Unit-4: LISTS **Teaching Hours: 9 Hrs.**

Lists: Using List- List Assignment and Equivalence – List Bounds- Slicing - Lists and Functions- Prime Generation with a List. List Processing: Sorting-Flexible Sorting- Search-List Permutations- Randomly Permuting a List- Reversing a List.

Unit-5:OBJECTS **Teaching Hours: 8 Hrs.**

Objects: Using Objects- String Objects- List Objects. Custom Types: Geometric Points- Methods- Custom Type Examples- Class Inheritance. Handling Exceptions: Motivation- Exception Examples- Using Exceptions - Custom Exceptions.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. **Gowrishankar S, Veena A, "Introduction to Python programming", 1st Edition, CRC Press/Taylor & Francis, 2008. (Units 1-3)**
2. **Learn to Program with Python, 3th Edition, Richard L. Halterman, Southern Adventist University. (Units 4-5)**

Reference Book:

1. **Core Python Programming, 2thEdition, Wesley J. Chun, Prentice Hall.**

2. **Jake VanderPlas,"Python Data Science Handbook: Essential Tools for working with Data",1st edition, O'Reilly Media, 2016.**

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	M	S	S	L	M
CO2	M	M	M	M	S	M	S	S	M	S
CO3	M	S	S	S	S	M	M	S	S	S
CO4	S	S	S	L	S	S	S	S	S	M
CO5	S	M	S	M	S	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Bachelor of Computer Science) – 2022-2023 onwards

Semester: VI **Paper type: Core – Practical -7**

Paper code: **Name of the Paper: Python Programming**

Lab **Credit: 2 Total Hours per Week: 4 Hrs.**

Lecture Hours:.. Tutorial Hours: ….. Practical Hours: 52 Hrs.

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……

Course Objectives

1. To know about basic data types, operators in Python.
2. To understand Loops in Python.
3. To understand the concepts of Arrays.
4. To understand how to handle string.
5. To know about functions.

Course Outcomes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to write a program using operators.
2. After studied unit-2, the student will be able to develop a program using loops.
3. After studied unit-3, the student will be able to implement program using Arrays.
4. After studied unit-4, the student will be able to implement the concept of String functions.
5. After studied unit-5, the student will be able to build application with basic expressions.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creat
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes

3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

LIST OF PRACTICAL EXCERCISES

1. Develop a Python program to find the area and perimeter of a circle.
2. Develop a Python program to generate Fibonacci series.
3. Develop a Python program to compute the GCD of two numbers.
4. Develop a Python program to generate first n prime numbers.
5. Develop a Python program to find the sum of squares of n natural numbers.
6. Develop a Python program to find the sum of the elements in an array.
7. Develop a Python program to find the largest element in the array.
8. Develop a Python program to check if the given string is a palindrome or not.
9. Develop a Python program to store strings in a list and print them.
10. Develop a Python program to find the length of a list, reverse it, copy it and then clear it.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be

implemented in the practices and report can be written for documentation, further discussion and research.

l. Extracurricular activities may be framed through their syllabus content.

m. Bring the industries to the campus. Bring the students to the industry.

n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	M	S	M	S	S
CO2	S	S	M	M	S	M	S	M	S	S
CO3	S	M	M	M	S	M	S	M	S	S
CO4	S	S	S	M	S	S	S	S	M	S
CO5	S	M	S	S	S	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Bachelor of Computer Science) – 2022-2023 onwards

Semester: VI **Paper type: Core - Practical - Practical - 8**

Paper code: **Name of the Paper: Open Source Programming**

Lab **Credit: 2 Total Hours per Week: 4 Hrs. Lecture**

Hours: ….. Tutorial Hours: .. Practical Hours: 52 Hrs.

……
……

Course Objectives

1. To understand the basic HTML Tags.
2. To understand the types of CSS.
3. To learn Javascript functions.
4. To know about PHP form elements.
5. To learn PHP with MYSQL database connectivity.

Course Outcomes

1. After studied unit-1, the student will be able to design static web pages.
2. After studied unit-2, the student will be able to link common style to the web pages using CSS.
3. After studied unit-3, the student will be able to validate form controls using javascript.
4. After studied unit-4, the student will be able to design dynamic webpages using PHP.
5. After studied unit-5, the student will be able to develop PHP program with MYSQL database connection.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	No	No	No	No	No

2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

LIST OF PRACTICAL EXCERCISES

1. Create a web page with Frames and Tables.
2. Create a web page incorporating CSS (Cascading Style Sheets).
3. Develop a shell program to find the factorial of an integer positive number.
4. Develop a shell program to find the details of a user session.
5. Create a simple calculator in JavaScript.
6. Develop a JavaScript program to scroll your name in the scrollbar.
7. Develop a program and check message passing mechanism between pages.
8. Application for Email Registration and Login using PHP and MySQL.
9. Program to Create a File and write the Data into it using PHP.
10. Program to perform the String Operation using Perl.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for

practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.

l. Extracurricular activities may be framed through their syllabus content.

m. Bring the industries to the campus. Bring the students to the industry.

n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	S	S	S	S
CO2	S	S	M	S	S	S	M	M	S	S
CO3	S	M	M	S	M	M	S	M	M	S
CO4	S	S	M	M	M	S	S	S	S	S
CO5	S	S	S	S	M	M	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Internal Elective II Paper - 2**

Paper code: **Name of the Paper: Big Data Analytics** **Credit: 3**

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To explore the fundamental concepts of big data analytics.
2. To learn to use various techniques for mining data stream.
3. To learn the Big data Business Perspective
4. To understand the applications using Map Reduce Concepts.
5. To introduce programming tools HIVE in Hadoop echo system.

Course Outcomes

1. After studied unit-1, the student will be able to understand the key issues in big data management.
2. After studied unit-2, the student will be able to outline big data planning, processing.
3. After studied unit-3, the student will be able to Acquire fundamental enabling techniques and scalable.
4. After studied unit-4, the student will be able to examine various big data tools and techniques.
5. After studied unit-5, the student will be able to achieve adequate perspectives of Big Data Analytics in various Applications like recommender system, Social Media Applications and etc.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No

5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO BIG DATA

Teaching Hours: 8 Hrs.

Introduction to big data: Introduction to Big Data Platform – Challenges of Conventional Systems – Intelligent data analysis – Nature of Data –.Characteristics of Data – Evolution of Big Data – Definition of Big Data – Challenges with Big Data – Volume, Velocity, Variety – Other Characteristics of Data – Need for Big Data–Analytic Processes and Tools – Analysis vs. Reporting.

Unit-2: MINING DATA STREAMS Teaching Hours: 8 Hrs.

Mining data streams: Introduction To Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams –Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) Applications – Case Studies – Real Time Sentiment Analysis– Stock Market Predictions.

Unit-3: BIG DATA FROM DIFFERENT PERSPECTIVES

Teaching Hours: 7 Hrs.

Big data from business Perspective: Introduction of big data–Characteristics of big data–Data in the warehouse and data in Hadoop– Importance of Big data– Big data Use cases– Patterns for Big data deployment. Big data from Technology Perspective:–Application Development in Hadoop–Getting your data in Hadoop.

Unit-4: HADOOP AND MAP REDUCE Teaching Hours: 9 Hrs.

Hadoop: The Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop– Scaling Out–Hadoop Streaming– Design o fHDFS–Java interfaces to HDFS Basics– Developing a Map Reduce Application–How MapReduce Works–Anatomy of a Map Reduce Job run–Failures–Job Scheduling–Shuffle and Sort – Task execution – Map Reduce Types and Formats– Map Reduce Features–Hadoop environment.

Unit-5:FRAMEWORKS Teaching Hours: 7

Objective: To introduce programming tools HIVE in Hadoop echo system.

Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive – fundamentals of HBase and ZooKeeper– IBM Info Sphere Big Insights and Streams.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

o. Book review and research paper review, syllabus and curriculum review.
p. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
q. Workshops, preparing technical term dictionaries from text books and reference books.
r. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
s. Forming digital library: collecting text and reference books, course material.
t. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
u. Extracurricular and cultural activities may be framed through the syllabus content.
v. Grouping students for self-discussion, self-learning process.
w. Following institution and intellectual and writing reports in the course field.
x. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
y. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
z. Extracurricular activities may be framed through their syllabus content.
aa. Bring the industries to the campus. Bring the students to the industry.
bb. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. "Intelligent Data Analysis", Michael Berthold, David J. Hand, Springer, 2007.
2. "Hadoop: The Definitive Guide ", Tom White Third Edition, Oreilly Media, 2012.

Reference Book:

1. **"Big Data and Analytics" SeemaAcharya, SubhasiniChellappan, Wiley 2015.**
2. **"Mining of Massive Datasets",AnandRajaraman and Jeffrey David Ullman,CUP,2012.**
3. **"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data" .Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos,McGrawHill Publishing, 2012.**
4. **"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Bill Franks, John Wiley& sons, 2012.**
5. **"Making Sense of Data", Glenn J. Myatt, John Wiley & Sons, 2007.**

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	S	S
CO2	S	S	S	S	M	S	M	M	S	S
CO3	S	S	S	S	S	S	M	M	S	S
CO4	S	M	M	S	M	S	M	M	S	S
CO5	S	M	M	M	M	S	M	M	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Internal Elective II Paper - 2**

Paper code: **Name of the Paper: Cryptography** **Credit: 3**

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. Understand OSI security architecture and classical encryption techniques.
2. Understand the different cryptographic operations of symmetric cryptographic algorithms.
3. Understand the different cryptographic operations of Public key cryptographic algorithms.
4. To make use of application protocols to design and manage a secure system.
5. To learn the configuration and manage E–mail and WLAN Security.

Course Outcomes

1. After studied unit-1, the student will be able to know the security attacks and services.
2. After studied unit-2, the student will be able to understand the concept of Encryption Standards.
3. After studied unit-3, the student will be able to understand public key cryptographic algorithms.
4. After studied unit-4, the student will be able to learn the concept of hash functions.
5. After studied unit-5, the student will be able to understand the Email security.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: COMPUTER AND NETWORK SECURITY **Teaching Hours: 8 Hrs.**

Computer Security Concepts –OSI security architecture –Security trends–Security attacks – Security Services– Security Mechanisms –Fundamental Security Design Principles – Attack Surfaces and Attack Trees – Model for Network Security – Network Standards.

Unit-2: SYMMETRIC CRYPTOGRAPHY **Teaching Hours: 8 Hrs.**

Symmetric Cipher – Classical Encryption Technique – Symmetric Cipher Model – Substitution Techniques, Transposition Technique – Steganography – Block Cipher and the Data Encryption Standard – The Data Encryption Standard – Differential and Linear Cryptanalysis – Block Cipher Principles. Advanced Encryption Standard – AES Structure – AES Transformation Function.

Unit-3: PUBLIC KEY CRYPTOGRAPHY **Teaching Hours: 7 Hrs.**

Public Key Cryptography and RSA Principles– RSA Algorithm, Key Management and other Public Key Cryptosystems Key Management, Diffie–Hellman Key Exchange, Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Pseudorandom Number Generation**.**

Unit-4: HASH FUNCTIONS AND DIGITAL SIGNATURES **Teaching Hours: 9 Hrs.**

Cryptographic Hash Functions – Application of Hash Functions – Two Simple Hash Functions – Secure Hash Algorithm(SHA) –Message Authentication Codes –Authentication requirement – Authentication function – MAC – HMAC – CMAC – Digital signature and authentication protocols – Digital Signature Standards –Digital Signatures Schemes– Digital Certificate – Key Management and Distribution.

Unit-5:SECURITY APPLICATIONS **Teaching Hours: 7 Hrs.**

Objective: To learn the configuration and manage E–mail and WLAN Security.

Intrusion Detection System– Password Management – Introduction to Firewall– Firewall Generations– Web Security – Wireless network Security – Electronic Mail Security– Internet Mail Architecture–S/MIME – Pretty Good Privacy (PGP).

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

cc. Book review and research paper review, syllabus and curriculum review.
dd. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
ee. Workshops, preparing technical term dictionaries from text books and reference books.
ff. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
gg. Forming digital library: collecting text and reference books, course material.
hh. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
ii. Extracurricular and cultural activities may be framed through the syllabus content.
jj. Grouping students for self discussion, self learning process.
kk. Following institution and intellectual and writing reports in the course field.
ll. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
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nn. Extracurricular activities may be framed through their syllabus content.
oo. Bring the industries to the campus. Bring the students to the industry.
pp. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. "Cryptography and Network security Principles and Practices",William Stallings,Pearson/PHI,Seventh Edition, 2017.

2."CRYPTOGRAPHY & NETWORK SECURITY" – Principles and Practices, William Stallings, Pearson Education, Third Edition.

Reference Book:

1. **"Modern Cryptography Theory and Practice", Wenbo Mao, Pearson Education, 2004.**
2. **"Cryptography and Network Security ",BehourzForouzan, DebdeepMukhopadyay,Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010.**
3. **"Quantum Cryptography and Secret–Key Distillation", Gilles van Assche, Cambridge University Press, 2010.**

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	M	M	S	S	S
CO2	S	S	S	M	M	M	M	S	M	S
CO3	S	M	M	M	M	M	M	S	S	S
CO4	S	S	M	M	M	S	S	S	M	S
CO5	S	S	S	M	M	M	M	M	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Internal Elective II** **Paper - 2**

Paper code: **Name of the Paper: DIGITAL IMAGE PROCESSING**
Credit: 3

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To know the basics of Digital image and techniques.
2. To understand various Image enhancement ideas.
3. To understand Image restoration techniques.
4. To understand degrees of image resolution and compression methods.
5. To understand concepts of image representation and recognition.

Course Outcomes

1. After studied unit-1, the student will be able to understand the concepts like Mat Lab, DIP, electromagnetic spectrum and etc.
2. After studied unit-2, the student will be able to analyze smoothing and sharpening techniques.
3. After studied unit-3, the student will be able to know about image filters.
4. After studied unit-4, the student will be able to gain knowledge about compression techniques.
5. After studied unit-5, the student will be able to know about image representation.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: FUNDAMENTALS **Teaching Hours: 8 Hrs.**

Introduction – Origin – Steps in Digital Image Processing – Components – Applications of DIP – Elements of Visual Perception – Light and Electro Magnetic Spectrum – Image Sensing and Acquisition – Image Sampling and Quantization – Images in Matlab– Pixels – Color models – Digital Image Processing in Multimedia.

Unit-2: IMAGE ENHANCEMENT
Teaching Hours: 8 Hrs.

Spatial Domain – Gray level transformations – Histogram Quantization – Histogram matching and processing – Basics of Spatial Filtering – Smoothing and Sharpening Spatial Filtering – Introduction to Fourier Series – Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal – Butterworth and Gaussian filters

Unit-3: IMAGE RESTORATION AND SEGMENTATION **Teaching Hours: 7 Hrs.**

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation– Active Contour Models – Snakes – Fuzzy Connectivity – Morphological processing– erosion and dilation.

Unit-4: WAVELETS AND IMAGE COMPRESSION **Teaching Hours: 9 Hrs.**

Wavelets – Sub band coding – Multi resolution expansions – Compression: Fundamentals – Image Compression models – Error Free Compression – Predictive Compression Methods – Vector Quantization – Variable Length Coding – Bit–Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards

Unit-5:IMAGE REPRESENTATION AND RECOGNITION **Teaching Hours: 7 Hrs.**

Knowledge Representation – Statistical Pattern Recognition – Neural Nets – Fuzzy Systems – Chain Code – Polygonal approximation, signature, boundary segments – Shape number – Fourier Descriptor moments – Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

qq. Book review and research paper review, syllabus and curriculum review.
rr. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
ss. Workshops, preparing technical term dictionaries from text books and reference books.
tt. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
uu. Forming digital library: collecting text and reference books, course material.
vv. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
ww. Extracurricular and cultural activities may be framed through the syllabus content.
xx. Grouping students for self-discussion, self-learning process.
yy. Following institution and intellectual and writing reports in the course field.
zz. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
aaa. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
bbb. Extracurricular activities may be framed through their syllabus content.
ccc. Bring the industries to the campus. Bring the students to the industry.
ddd. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. **"Digital Image Processing," Rafael C. Gonzalez, Richard E.Woods, Prentice Hall, Third Edition, 2008.**
2. **"Digital Image Processing and Computer Vision," Sonka, Hlavac, Boyle, Cengage Learning, 2009**
3. **“Fundamentals of Digital Image Processing”, Anil Jain K, PHI Learning Pvt. Ltd., 2011.**

Reference Book:

1. **“Digital Image Processing”, S. Sridhar, Oxford University Press; Second edition, 2016.**
2. **“Digital Image Processing”, Gonzalez &woods, Pearson Education India, 2016.**

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	M	M	M	S	S
CO2	S	S	M	M	M	M	S	M	S	S
CO3	S	S	M	M	M	S	S	S	M	S
CO4	S	M	S	M	S	M	M	S	S	S
CO5	S	M	M	M	S	M	M	M	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Internal Elective III Paper - 3**

Paper code: **Name of the Paper: ARTIFICIAL INTELLIGENCE**
Credit: 3

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To know the basics of Artificial Intelligence.
2. To Understand the Methods and algorithms in AI.
3. To learn to represent knowledge in solving AI problems.
4. To Understand Statistical logics and know about Software agents.
5. To learn how Machine learning is related to AI.

Course Outcomes

1. After studied unit-1, the student will be able to recall the fundamentals of artificial intelligence
2. After studied unit-2, the student will be able to understand the techniques used for AI
3. After studied unit-3, the student will be able to know about knowledge representation.
4. After studied unit-4, the student will be able to gain knowledge about fuzzy logic.
5. After studied unit-5, the student will be able to evaluate the design of new artificial intelligence and machine learning applications

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE:
Teaching Hours: 8 Hrs.

History of AI – Artificial Narrow Intelligence (ANI) – Artificial General Intelligence (AGI) – Artificial Super Intelligence (ASI) – Characteristics – Types of AI – Domains – Programming Languages of AI – Applications of AI – Future of AI.

Unit-2: AI – PROBLEM SOLVING METHODS:
Teaching Hours: 8 Hrs.

Problem solving Methods – Search Strategies: Uninformed – Informed – Heuristics – Generate and test – hill climbing – Best first search – problem reduction – Local Search Algorithms and Optimization – Game Playing mini–max procedure – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games

Unit-3: AI – KNOWLEDGE REPRESENTATION:
Teaching Hours: 7 Hrs.

Procedural Versus declarative knowledge – logic programming – Forward Versus backward reasoning – Matching – Control knowledge – Ontological Engineering– Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories –Reasoning with Default Information.

Unit-4: STATISTICAL REASONING AND AGENTS: Teaching Hours: 9 Hrs.

Probability and Bayes Theorem – Certainty factors – Probabilistic Graphical Models – Bayesian Networks – Markov Networks – Fuzzy Logic. Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi–agent systems.

Unit-5:MACHINE LEARNING AND APPLICATIONS Teaching Hours: 7 Hrs.

Types of Machine Learning – Neural Networks – Deep Learning – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. **“Artificial Intelligence”, Elaine Rich, Kevin Knight, Tata McGraw Hill, II Edition.**
2. **"Artificial Intelligence: A Modern Approach," Stuart Russell, Peter Norvig, Third Edition, Prentice Hall of India, New Delhi, 2010.**
3. **“Prolog: Programming for Artificial Intelligence”, I. Bratko, Addison – Wesley Educational Publishers Inc., Fourth edition 2011.**

Reference Book:

1. **"Machine Learning for Beginners 2019", Matt Henderson, This Is Charlotte, 2019**
2. **"Introduction to Artificial Intelligence and Expert Systems", Dan W. Patterson, Pearson, 2015**

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	M	M	M	S	S
CO2	S	M	S	S	M	M	S	M	S	S
CO3	S	S	M	M	S	M	M	S	S	S
CO4	S	M	S	M	M	M	M	S	S	S
CO5	S	S	M	M	S	S	M	M	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Internal Elective III** **Paper - 3**

Paper code: **Name of the Paper: SYSTEM SOFTWARE**
Credit: 3

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To understand the basic concepts of system software
2. Ability to trace the path of a source code to object code and to executable file
3. To design and implementation of loaders and linkers
4. To understand the concepts of macro processor
5. Ability to analyze the functions of compilers

Course Outcomes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to analyze CISC and RISC machines.
2. After studied unit-2, the student will be able to know how assemblers are working.
3. After studied unit-3, the student will be able to distinguish Linker and Loader.
4. After studied unit-4, the student will be able to learn macro processor.
5. After studied unit-5, the student will be able to understand the functions of compilers.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: INTRODUCTION TO SYSTEM SOFTWARE **Teaching Hours: 8 Hrs.**

System software vs. Application software – Different types of system software – SIC& SIC/XE Architecture – traditional (CISC) machines – RISC machines.

Unit-2: ASSEMBLERS **Teaching Hours: 8 Hrs.**

Basic assembler functions– Machine dependent and independent assembler features– Assembler design options–One pass assemblers–Multi pass assemblers– MASM assembler.

Unit-3: LOADERS AND LINKERS **Teaching Hours: 7 Hrs.**

Basic loader functions–Simple bootstrap loaders – Machine dependent and independent loader features–Linkage editors– Dynamic linking

Unit-4: MACRO PROCESSOR **Teaching Hours: 9 Hrs.**

Basic macro processor functions–Machine dependent and independent macro processor features–Macro processor design options.

Unit-5:COMPILERS **Teaching Hours: 7 Hrs.**

Basic compiler functions–Machine dependent compiler features–Machine independent compiler features–Compiler design options the YACC compiler–Compiler.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

o. Book review and research paper review, syllabus and curriculum review.
p. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
q. Workshops, preparing technical term dictionaries from text books and reference books.
r. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
s. Forming digital library: collecting text and reference books, course material.
t. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
u. Extracurricular and cultural activities may be framed through the syllabus content.
v. Grouping students for self-discussion, self-learning process.
w. Following institution and intellectual and writing reports in the course field.

x. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
y. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
z. Extracurricular activities may be framed through their syllabus content.
aa. Bring the industries to the campus. Bring the students to the industry.
bb. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. **"System Software–An introduction to system programming", Leland L. Beck & D. Manjula, Pearson Education, 3rd edition, 2007.**
2. **"Compilers – Principles, techniques and tools", A.V. Aho, Ravi Sethi, J.D. Ullman, 2ndEdition, Pearson Education, 2011.**

Reference Books:

1. **""Systems Programming and Operating Systems", D.M. Dhamdhere, Second Revised Edition, Tata McGraw Hill, 2000.**
2. **"Systems Programming", John J. Donovan, Tata McGraw Hill Edition, 2000.**
3. **"Systems Programming", Srimanta Pal, Oxford University Press, 2011.**

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	S	M	M	S
CO2	S	S	M	M	S	M	S	M	S	S
CO3	S	M	M	S	M	S	M	M	S	S
CO4	S	M	S	S	M	S	M	S	S	S
CO5	S	M	M	M	M	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Internal Elective III** **Paper - 3**

Paper code: **Name of the Paper: MOBILE COMPUTING**
Credit: 3

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. To understand basic concepts of mobile computing.

2. To learn the basics of mobile telecommunication system

3. To comprehend wireless LAN and cellular systems.

4.To understand protocols at network and transport layer.

5. To learn development of applications in mobile computing platform.

Course Outcomes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand basic concepts of mobile computing.

2. After studied unit-2, the student will be able to learn the basics of mobile telecommunication system

3. After studied unit-3, the student will be able to comprehend wireless LAN and cellular systems.

4. After studied unit-4, the student will be able to understand protocols at network and transport layer.

5. After studied unit-5, the student will be able to learn development of applications in mobile computing platform.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: WIRELESS COMMUNICATION FUNDAMENTALS Teaching Hours: 8 Hrs.

Introduction–Applications–A short History of wireless Communications–Wireless Transmission – Frequencies for Radio transmission–Signals–Antennas–Signal Propagation–Multiplexing–Modulations–Amplitude shift keying–Frequency shift keying–Phase shift keying–Spread Spectrum.

Unit-2: MEDIUM ACCESS CONTROL AND TELECOMMUNICATION SYSTEM

Teaching Hours: 8 Hrs..

SDMA–FDMA–TDMA–Fixed TDM–Classical Aloha–CDMA–Global System for Mobile Communications –GPRS–Satellite Systems –Basics –Applications–Broadcast Systems – Digital Audio Broadcasting – Digital Video Broadcasting. learn development of applications in mobile computing platform.

Unit-3: WIRELESS NETWORKS
Teaching Hours: 7 Hrs.

Infrared vs. Radio Transmission– Infrastructure Networks–Ad hoc Networks – IEEE 802.11 –System Architecture–Protocol Architecture–Bluetooth–User scenarios–Bluetooth Architecture–Introduction to Wireless ATM –Services–Location Reference Model.

Unit-4: MOBILE NETWORK LAYER Teaching Hours: 9 Hrs.

Mobile IP–Goals– Assumption–Entities and Terminology– IP Packet delivery – Agent advertisement and discovery–Registration–Tunnelling and encapsulation–Optimizations–Dynamic Host Configuration Protocol (DHCP) –Routing –DSDV–DSR – Alternative Metrics.

Unit-5: WIRELESS APPLICATION PROTOCOL
Teaching Hours: 7 Hrs.

Introduction–Protocol Architecture–Wireless Markup Language (WML)–WML Script– Applications–Wireless Telephony Application (WTA) – Wireless Telephony Application Architecture.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
g. Extracurricular and cultural activities may be framed through the syllabus content.
h. Grouping students for self-discussion, self-learning process.
i. Following institution and intellectual and writing reports in the course field.
j. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
k. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
l. Extracurricular activities may be framed through their syllabus content.
m. Bring the industries to the campus. Bring the students to the industry.
n. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Textbooks:

1. "Mobile Communications", Jochen Schiller –PHI/Pearson Education, Second Edition, 2003.
2. " Mobile Computing", Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal –Tata McGraw Hill Publications, Second edition, 2010.

Reference Books:

1. **"**Principles of Wireless Networks", KavehPahalavan, PrasanthKrishnamoorthy, PHI/Pearson Education, 2003.

2. "Fundamentals of Mobile and Pervasive Computing", Frank Adelstein, ,SandeepK.S.Gupta, Golden G.Richard III, Loren Schwiebert –Tata McGraw Hill Publications, 2005.
3. "Wireless Communications and Networks", Williams Stallings–Pearson Education, Second Edition, 2009.

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	S	M	M	S
CO2	S	S	M	M	S	M	S	M	S	S
CO3	S	M	M	S	M	S	M	M	S	S
CO4	S	M	S	S	M	S	M	S	S	S
CO5	S	M	M	M	M	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(BCA) – 2022-2023 onwards

Semester: VI **Paper type: Skill Based Subject IV Paper - 4**

Paper code: **Name of the Paper: OBJECT ORIENTED ANALYSIS AND DESIGN**
Credit: 2

Total Hours per Week: 3 **Lecture Hours: 39.** **Tutorial Hours: …..** **Practical Hours: …..**

……

Course Objectives

1. Learn the UML analysis and design diagrams.

2. Apply appropriate object model and design patterns.

3. Create object code from design Patterns

4. Learn to map design to code, Compare and contrast various testing techniques.

5. At the end of the course, the student should be able to Design and implement projects using OO concepts.

Course Outcomes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand UML analysis and design diagrams.

2. After studied unit-2, the student will be able to Apply appropriate object model and design patterns.

3. After studied unit-3, the student will be able to ccreate object code from design Patterns

4. After studied unit-4, the student will be able to design to code, Compare and contrast various testing techniques.

5. After studied unit-5, the student will be able to Design and implement projects using OO concepts.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: UML DIAGRAMS

Teaching Hours: 8 Hrs.

Introduction to OOAD – Role of Analysis and Design in Software Development – Meaning of Object Orientation – Overview of Various OOAD Methodologies – Unified Process – UML diagrams Goals of UML – Use Case – Actors and Use Cases – Use Case Relationships – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams.

Unit-2:OBJECT MODEL AND DESIGN PATTERNS

Teaching Hours: 8

The Object Model – The Evolution of the Object Model – Foundations of the Object Model – Elements of the Object Model – Applying the Object Model. GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller – Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer.

Unit-3: APPLYING DESIGN PATTERNS

Teaching Hours: 7 Hrs.

The Nature of an Object – Relationships among Objects – The Nature of a Class – Relationships among Classes – The Interplay of Classes and Objects – On Building Quality Classes and Objects –System sequence diagrams – Relationship between sequence diagrams and use cases diagrams –Notations: The Unified Modelling Language – Package Diagrams – Component Diagrams – Deployment Diagrams – Activity Diagrams – Logical architecture refinement – UML class diagrams – UML interaction diagrams – Applying GoF design patterns.

Unit-4: CLASSIFICATION, CODING AND TESTING **Teaching Hours: 9 Hrs.**

Classification: The importance of proper classification – Identifying classes and objects – Key abstractions and Mechanisms – Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing – GUI Testing – OO System Testing.

Unit-5:CASE STUDY

Teaching Hours: 7 Hrs.

Case study – the Next Gen POS system, Inception –Use case Modelling – Relating Use cases – include, extend and generalization – Elaboration – Domain Models – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition.

Internal Assessment Methods: (The following items may be brought under test, seminar and assignment framework)

o. Book review and research paper review, syllabus and curriculum review.
p. Data collection and paper writing practices: books level, field study level. Using the course study for society and nature development – exercise
q. Workshops, preparing technical term dictionaries from text books and reference books.
r. Preparing question paper by the candidates: objective type, descriptive type, training can be given by the teacher
s. Forming digital library: collecting text and reference books, course material.
t. Villages, institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
u. Extracurricular and cultural activities may be framed through the syllabus content.
v. Grouping students for self-discussion, self-learning process.
w. Following institution and intellectual and writing reports in the course field.
x. Bloom Taxonomy may be introduced for teaching, learning and evaluation process within the framework of question setting pattern and internal assessment pattern.
y. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
z. Extracurricular activities may be framed through their syllabus content.
aa. Bring the industries to the campus. Bring the students to the industry.
bb. Ph.D. Research Methodology is applicable to write project report and any kind of research reports like assignment, seminar papers, case study reports, etc.

Text book:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object–Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.
2. Mahesh P. Matha, "Object – Oriented Analysis and D esign Using UML" , PHI Learning Private Limited, New Delhi, 2008.
3. Grady Booch Robert A. Maksimchuk Michael W. Engle Bobbi J. Young, Ph.D. Jim Conallen Kelli A. Houston "Object–Oriented Analysis and Design with Applications" Third Edition, Pearson Education, Inc.,April 2007.

Reference Book:

1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object–Oriented Software", Addison–Wesley, 1995.
2. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.
3. Paul C. Jorgensen, "Software Testing:– A Craftsman‟s Approach", Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.

Course Material: website links, e-Books and e-journals
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	S	M	M	S
CO2	S	S	M	M	S	M	S	M	S	S
CO3	S	M	M	S	M	S	M	M	S	S
CO4	S	M	S	S	M	S	M	S	S	S
CO5	S	M	M	M	M	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)