B.Sc. ARTIFICIAL INTELLIGENCE
UNDER CBCS PATTERN
(With effect from 2022 - 2023)
The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components / Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
							CIA	Uni. Exam	Total
		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	Discrete Mathematics	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
		Sem. 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	Java Programming	25	75	100
12.	III	Core Practical	Practical-2	2	2	Java Programming Lab	25	75	100
13.	III	Allied-1	Paper-2	7	5	Operations Research	25	75	100
14.	**III**	**PE**	**Paper 1**	**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
		Sem. Total		**36**	**27**		**225**	**675**	**900**

S.NO.	Part	Study Components		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
		SEMESTER III							
17.	I	Language	Paper-3	6	4	Tamil/ Other Languages	25	75	100
18.	II	English	Paper-3	6	4	English	25	75	100
19.	III	Core Theory	Paper-3	3	3	Tensor Flow	25	75	100
20.	III	Core Practical	Practical-3	3	3	Tensor Flow Lab	25	75	100
21.	III	Allied II	Paper-3	4	3	Statistical Methods and Their Applications I	25	75	100
	III	Allied II	Practical	3	0	Statistics Practical	0	0	0
22.	IV	Skill Based Subject	Paper-1	3	2	Design and Analysis of Algorithms	25	75	100
23.	IV	Non-Major Elective	Paper-1	2	2	Introduction to Information Technology	25	75	100
		Sem. Total		**30**	**21**		**175**	**525**	**700**
		SEMESTER IV					CIA	Uni. Exam	Total
24.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
25.	II	English	Paper-4	6	4	English	25	75	100
26.	III	Core Theory	Paper-4	3	3	Advanced Python Programming	25	75	100
27.	III	Core Practical	Practical-4	3	3	Advanced Python Programming Lab	25	75	100
28.	III	Allied II	Paper-4	4	3	Statistical Methods and their Applications II	25	75	100
29.	III	Allied II	Practical	3	2	Statistics Practical	25	75	100
30.	**IV**	**NMSDC II : Digital Skills for Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	**25**	**75**	**100**
31.	IV	Non-Major Elective	Paper-1	2	2	Internet Technology	25	75	100
		Sem. Total		**30**	**23**		**200**	**600**	**800**

S.NO.	Part	Study Components		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
SEMESTER V									
32.	III	Core Theory	Paper-5	6	4	Principles of Robotics	25	75	100
33.	III	Core Theory	Paper-6	6	4	R Programming	25	75	100
34.	III	Core Theory	Paper–7	4	3	Artificial Intelligence & Knowledge Representation	25	75	100
35.	III	Core Practical	Practical-5	4	3	Robotics Laboratory	25	75	100
36.	III	Core Practical	Practical-6	4	3	R Programming Lab	25	75	100
37.	III	Internal Elective	Paper-1	3	3	Fuzzy Logic and Neural Networks	25	75	100
38.	IV	Skill Based Subject	Paper-2	3	2	Relational Database Management System	25	75	100
				30	22		175	525	700
SEMESTER VI							CIA	Uni. Exam	Total
39.	III	Core Theory	Paper-8	4	4	Machine Learning Techniques	25	75	100
40.	III	Core Theory	Paper-9	4	4	Natural Language Processing	25	75	100
41.	III	Core Practical	Practical-7	4	3	Machine Learning Lab	25	75	100
42.	III	Core Practical	Practical-8	4	2	Natural Language Processing Lab	25	75	100
43.	III	Project		5	5	Project Work (Group/Individual Project)	25	75	100
44.	III	Internal Elective	Paper - 2	3	3	Computer Organization	25	75	100
45.	III	Internal Elective	Paper - 3	3	3	Operating System	25	75	100
46.	IV	Skill Based Subject	Paper - 3	3	2	Ethical Hacking	25	75	100
47.	V	Extension Activities		0	1		100	0	100
48.	-	**NMSDC III : Employability Readiness**	-	0	0	(choose any one) • Naandi • Unnati • Quest • Izpay • IBM Skills build	-	-	-
		Sem. Total		30	27		300	600	900
					142				4600

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc., Artificial Intelligence) – 2022-2023 onwards

Programme Objectives:

1. Students will establish themselves as effective professionals by solving real problems through the use of computer science knowledge and with attention to team work, effective communication, critical thinking and problem solving skills.
2. Students will develop professional skills that prepare them for immediate employment and for life-long learning in advanced areas of computer science and related fields.
3. Students will demonstrate their ability to adapt to a rapidly changing environment by having learned and applied new skills and new technologies.
4. Students will be provided with an educational foundation that prepares them for their excellence.

5. Students will prepares for leadership roles along diverse career paths with encouragement to professional ethics and active participation needed for a successful career.

Programme Educational Objectives:

1. To practice their profession with confidence by applying new ideas and technologies in the domain of Artificial Intelligence and Machine Learning for the sustainable growth of Industry and Society.
2. To pursue higher studies for professional growth with superior ethics and character.
3. To engage in research leading to innovations/products or become a successful Entrepreneur.

Programme Outcomes:

1. Apply the knowledge of mathematics and science to the solution of complex engineering problems.
2. Identify, formulate, review research literature, and analyze complex problems reaching substantiated conclusions using first principles of mathematics, natural sciences.
3. Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Create, select, and apply appropriate techniques, resources, and modern tools including prediction and modelling to complex activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

7. Understand the impact of the solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on complex activities and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Programme Specific Outcomes:

On Completion of B.Sc. Artificial Intelligence Programme, graduates will be able to

1. Demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering for designing intelligent systems.
2. Apply computational knowledge and project development skills to provide innovative solutions.
3. Use tools and techniques to solve problems in AI and ML.

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.**

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.**
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.**

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.**

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.**

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.

Textbooks:

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.

Course Material:
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)

Semester: I   Paper type: Core 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 Hrs.

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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 analyzing 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)

Semester: I   **Paper type: Allied**

Paper code: **Name of the Paper: Discrete Mathematics**   **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: RECURRENCE RELATIONS AND GENERATING FUNCTIONS

Teaching Hours: 19 Hrs.

Recurrence - Polynomials and their Evaluations - Recurrence Relations - Solution of Finite Order Homogeneous [linear] Relations - Solutions of Non-homogeneous Relations.

Unit-2: MATHEMATICAL LOGIC   **Teaching Hours: 18 Hrs.**

TF Statements - Connectives - Atomic and Compound Statements - Well-formed [Statement Formulae] - Parsing - Truth Table of a Formula - Tautology - Tautological Implications and Equivalence of Formulae.

Unit-3: MATHEMATICAL LOGIC   **Teaching Hours: 18 Hrs.**

Replacement process - Functionally complete sets of connectives and Duality law – Normal Forms - Principal Normal Forms.

Unit-4: LATTICES   **Teaching Hours: 18 Hrs.**

Lattices [omit example 15 Pp No.10.6) - Some properties of Lattices - New Lattices (omit remarkPp 10.14) - Modular and Distributive Lattices (omit theorem 10 and 17, Example 4
- Pp 10.23,Example 11 - Pp 10.24)

Unit-5: BOOLEAN ALGEBRA   **Teaching Hours: 18 Hrs.**

Boolean Algebra - Boolean Polynomials - Karnaugh Maps

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.
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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.

Text book:
1. 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.

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	S	S	S	S	S
CO2	S	M	M	S	S	M	S	S	S	S
CO3	S	S	S	M	M	M	S	S	S	S
CO4	S	M	M	S	S	S	S	S	M	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)

Semester: II   **Paper type: Core Theory – Paper 2**
Paper code: **Name of the Paper: Java Programming**   **Credit: 4**

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

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Course Objectives

1. To know about a General-purpose and Purely object-oriented programming language including data types.
2. To understand the concept of garbage collection and operators
3. To know about the concept of Array and string
4. To know about the concept of Files
5. To understand the concept of Applets

Course Outcomes

1. After studied unit-1, the student will be able to understand the concept of General-purpose and Purely object-oriented programming language including data types and classes
2. After studied unit-2, the student will be able to understand the concept of loops

3. After studied unit-3, the student will be able to understand the concepts of Arrays

4. After studied unit-4, the student will be able to understand the concepts of Files

5. After studied unit-5, the student will be able to understand the concept of internet programming using applets and GUI-based

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: DECLARATIONS AND ACCESS CONTROL: IDENTIFIERS AND KEYWORDS

Teaching Hours: 12 Hrs.

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

- Non access Member Modifiers - Constructor Declarations - Variable Declarations. Declare and Use enums: Declaring enums. Object Orientation: Encapsulation - Inheritance and Polymorphism- Polymorphism - Overriding / Overloading: Overridden Methods -Overloaded Methods.

Unit-2: OBJECT ORIENTATION: CASTING - IMPLEMENTING AN INTERFACE

Teaching Hours: 13 Hrs.

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 – instance of Comparison - Arithmetic Operators - Conditional Operator - Logical Operators.

Unit-3: WORKING WITH STRINGS, ARRAYS, AND ARRAY LISTS

Teaching Hours: 15 Hrs.

Using String and StringBuilder: The String Class - The StringBuilder Class - Important Methods in the StringBuilder Class. Using Arrays: Declaring an Array -Constructing an Array - Initializing an Array. Using ArrayList:ArrayList Methods in Action - Important Methods in the ArrayList 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, StringBuilder, and StringBuffer - Dates, Numbers, Currencies,and Locales.

Unit-4: I/O AND NIO: FILE NAVIGATION AND I/O   Teaching Hours: 13 Hrs.

 Creating Files Using the File Class - Using FileWriter and FileReader. File and Directory Attributes -DirectoryStream - Serialization. Generics and Collections: toString(), hashCode(), and equals(): The toString() 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 ThreadPools.

Unit 5: APPLETS   Teaching Hours: 12 Hrs.

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.

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. 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.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	S	S
CO2	S	S	M	M	M	S	S	S	S	S
CO3	S	M	M	M	M	S	S	S	M	S
CO4	S	M	M	M	M	S	S	S	S	S
CO5	S	S	M	M	M	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 Artificial Intelligence) – 2022-2023 onwards

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

Paper code: Name of the Paper: Java Programming 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 understand the concepts of classes and objects.
2. To know about layout managers.
3. To gain knowledge of frames and menus.
4. To understand the concept of RMI.
5. To learn how to handle exceptions.

Course Outcomes

1. After studied unit-1, the student will be able to understand the concept of purely object-oriented programming language including data types and classes.

2. After studied unit-2, the student will be able to implement layout managers.

3. After studied unit-3, the student will be able to develop an application using frames.

4. After studied unit-4, the student will be able to understand the concepts of RMI.

5. After studied unit-5, the student will be able to handle exceptions in program.

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. 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

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	M	M	M	M	M	S	S	S	S
CO2	S	M	M	M	M	M	S	M	S	M
CO3	S	M	S	M	M	S	S	M	S	S
CO4	S	M	S	M	M	M	S	M	S	M
CO5	S	M	M	M	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
(Bachelor of Artificial Intelligence) – 2022-2023 onwards

Semester: II   **Paper type: Allied**

Paper code: **Name of the Paper: Operations Research**   **Credit: 5**

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:   **Teaching Hours: 18 Hrs.**
Linear programming problem - Mathematical formulation of the problem - Graphical solution method - Simplex method - The Big-M method -Duality - Dual simplex method (Simple Problems).

UNIT-2: Partial Differential Equations   **Teaching Hours: 18 Hrs.**
Definitions of the transportation model - Formulation and solution of transportation Models_ Finding an initial basic feasible solution (NWCM - LCM -VAM) - Degeneracy in Transportation Problem - Transportation Algorithm (MODI Method)

UNIT-3:   **Teaching Hours: 19 Hrs.**
Definition of Assignment models - Mathematical representation of assignment models – Comparison with the transportation models - Solution of the assignment model - The Hungarian methods for solution of the assignment models - variation of the assignment problem .Travelling salesman problem.

UNIT-4 : Vector Analysis   **Teaching Hours: 18 Hrs.**
Games and Strategies - Two person zero sum - Some basic terms - the maximin-minimax principle – saddle points - Games without saddle points-Mixed strategies - graphic solution 2xn and mx2 games.

UNIT-5: Vector Analysis (continued)   **Teaching Hours: 18 Hrs.**
Simulation - application - advantages and disadvantages - Monte Carlo method - simple problems.

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.   Gupta P.K.and Hira D.S., (2000) Problems in Operations Research, S.Chand & Co. Delhi

Reference Books:
1.   J.K.Sharma, (2001) Operations Research: Theory and Applications, Macmillan, Delhi

2.   KantiSwaroop, Gupta P.K. and Manmohan, (1999) *Problems in Operations Research*, Sultan Chand & Sons., Delhi

3. V.K.Kapoor [1989] *Operations Research*, sultan Chand & sons.

Ravindran A., Philips D.T. and Solberg J.J., (1987) *Operations research*, John Wiley & Sons, New York.

4. Taha H.A. (2003) *Operations Research,* Macmillan Publishing Company, New York.

5. S.J.Venkatesan, *Operations Research,* J.S. Publishers, Cheyyar-604 407.

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)

Semester: III   Paper type: Core Theory – Paper 3

Paper code: Name of the Paper: Tensor Flow   **Credit: 3**

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

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Course Objectives

1. To understand basic operations, constant, variables etc.

2. To understand linear and nonlinear regressions.

3. To understand basics of variable sharing principles.

4. To understand the basic of encoder and its networks

5. To understand the basics of language translations. .

Course Outcomes

1. After studied unit-1, the student will be able to understand the concept vvariables,and Data Types, Operators and Expressions

2. After studied unit-2, the student will be able to understand the concepts of linear and nonlinear regressions.

3. After studied unit-3, the student will be able to understand the concepts of variable sharing principle.

4. After studied unit-4, the student will be able to understand the concepts of encoder with networks.

5. After studied unit-5, the student will be able to understand the concepts of language translations.

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: 8 Hrs.**

Overview of Tensorflow: Why Tensorflow? Graphs and Sessions. Operations: Basic operations, constants, variables, Control dependencies, Data pipeline, TensorBoard.

Unit-2: LINEAR AND LOGISTIC REGRESSION   **Teaching Hours: 8 Hrs.**

TensorFlow's Optimizers, tf.data - Example: Birth rate - life expectancy, MNIST dataset. **Eager execution:** Example: word2vec, linear regression

Unit-3: VARIABLE SHARING AND MANAGING EXPERIMENTS   **Teaching Hours: 8 Hrs.**

Interfaces Name scope, variable scope Saver object, checkpoints, Autodiff Example: word2vec. Introduction to ConvNet.

Unit-4: CONVNET IN TENSORFLOW   **Teaching Hours: 7 Hrs.**

Example: image classification, GANs , Variational Auto- Encoders, Recurrent Neural Networks: Example: Character-level Language Modelling

Unit-5: SEQ2SEQ WITH ATTENTION   **Teaching Hours: 8 Hrs.**

Example: Neural machine translation, Beyond RNNs: Transformer, Tensor2Tensor: Dialogue agents, Reinforcement Learning in Tensorflow, Keras.

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. Reza Bosagh Zadeh, Bharath Ramsundar, "TensorFlow for Deep Learning", 2018. Architecture, Pearson Education.

Reference Books:

1. Giancarlo Zaccone,Md.Rezaul Karim, Ahmed Menshawy" Deep Learning with Tensorflow" , 2017

2. Ian Goodfellow, "Deep Learning", 2016.

3. Francois Chollet, "Deep Learning with Python", 2017.

Mapping with Programme Outcomes

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

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

Semester: III   Paper type: Core – Practical - 3

Paper code: Name of the Paper: Tensor Flow Lab   Credit: 3

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

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Course Objectives

1. To understand basic operations, constant, variables etc.

2. To understand linear and nonlinear regressions.

3. To understand basics of variable sharing principles.

4. To understand the basic of transformer

5. To understand the basics of reinforcement learning in tensor flow.

Course Outcomes

1. The student will be able to understand the concept variables,and Data Types, Operators and Expressions

2. The student will be able to understand the concepts of linear and nonlinear regressions.

3. The student will be able to understand the concepts of variable sharing principle.

4. The student will be able to understand the concepts of encoder with transformer

5. The student will be able to understand the concepts of reinforcement learning in tensorflow.

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. Implement concepts of Basic operations, constants and variables.

2. Implement concepts of Control dependencies

3. Implement concepts of Data pipeline, TensorBoard

4. Implement concepts of TensorFlow's Optimizers

5. Implement concepts of Linear regression

6. Implement concepts of Interfaces Name scope, Saver object, checkpoints

7. Implement concepts of Autodiff Example: word2vec

8. Implement concepts of Image classification

9. Implement concepts of GANs , Variational Auto-Encoders

10. Implement concepts of Variational Auto-Encoders

11. Implement concepts of Recurrent Neural Networks

12. Implement concepts of Seq2seq with Attention: Neural machine translation

13. Implement concepts of Transformer

14. Implement concepts of Tensor2Tensor: Dialogue agents

15. Implement concepts of Reinforcement Learning in Tensorflow, Keras

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.
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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.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	M	S	S	S	S
CO2	S	M	M	M	M	M	S	M	S	M
CO3	S	M	S	M	M	S	S	M	S	S
CO4	S	M	S	M	M	M	S	M	S	M
CO5	S	M	M	M	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
(Bachelor of Artificial Intelligence) – 2022-2023 onwards

Semester: III   Paper type: Allied Paper – Paper 3

Paper code: Name of the Paper: Statistical Methods And Their Applications I   Credit: 3

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

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Course Objectives

Course Outcomes

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:   **Teaching Hours: 8 Hrs.**

Introduction - scope and limitations of statistical methods - classification of data -Tabulation of data - Diagrammatic and Graphical representation of data - Graphical determination of Quartiles ,Deciles and Percentiles.

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

Measures of location : Arithmetic mean, median, mode, geometric mean and Harmonicmean and their properties.

Unit-3:   **Teaching Hours: 8 Hrs.**

Measures of dispersion : Range, Quartile deviation, mean deviation, Standard deviation,combined Standard deviation, and their relative measures.

Unit-4:   **Teaching Hours: 7 Hrs.**

Measures of Skewness Karl Pearson's, Bowley's, and kelly's and co-efficient ofSkewness and kurtosis based on moments.

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

Correlation - Karl Pearson - Spearman's Rank correlation - concurrent deviationmethods.Regression Analysis: Simple Regression Equations.

Internal Assessment Methods: (The following items may be brought under test, seminar andassignment 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. Fundamental of Mathematical Statistics - S.C. Gupta & V.K. Kapoor - Sultan Chand

2. Statistical Methods - Snedecor G.W. & Cochran W.G. oxford & +DII

3. Elements of Statistics - Mode . E.B. - Prentice Hall

4. Statistical Methods - Dr. S.P. Gupta - Sultan Chand & Sons

Reference Books:

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	M	S	S	M	S
CO2	S	M	M	S	S	M	S	S	M	S
CO3	S	M	M	S	S	M	M	S	M	S
CO4	S	M	M	S	M	M	M	S	M	S
CO5	S	M	M	S	M	M	M	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 Artificial Intelligence) – 2022-2023 onwards

Semester: III   Paper type: Skill based Subject – Paper 1

Paper code: Name of the Paper: Design and Analysis of algorithm   Credit: 2

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

……………………………………………………………………………………………………

Course Objectives

1. To understand various algorithm design techniques

2. This technique is the basis of efficient algorithms for all kinds of problems**.**

3. This is a simple approach which tries to find the best solution at every step.

4. Providing a general insight into the dynamic programming approach.

5. Algorithm design paradigm for discrete and combinatorial optimization problems.

Course Outcomes

1. After studied unit-1, the student will be able to gain experience with space and time complexity

2. After studied unit-2, the student will be able to understand the concepts of divide and conquer

3. After studied unit-3, the student will be able to understand the concepts of greedy method

4. After studied unit-4, the student will be able to understand the concepts of multistage graph

5. After studied unit-5, the student will be able to understand the concepts of backtracking

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: ALGORITHM AND ANALYSIS   **Teaching Hours: 8 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: DIVIDE AND CONQUER   **Teaching Hours: 8 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: THE GREEDY METHOD   **Teaching Hours: 8 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: DYNAMIC POGRAMMING, TRAVERSAL & SEARCHING

                                                Teaching Hours: 8 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: BACKTRACKING & BRANCH AND BOUND   **Teaching Hours: 7 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 Books:
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.

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	S	S	S	S	S	S	S	S
CO3	S	M	M	S	M	M	S	M	S	S
CO4	S	S	M	S	M	M	M	S	S	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
(Bachelor of Artificial Intelligence) – 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 Hrs. Lecture Hours: 26 Hrs. 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 WideWeb-Other Facilities Provided by Browsers - Audio on the Internet.**Societal Impactsof Information Technology:** CareersinInformation 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)

onwardsSemester: IV   Paper type: Core Theory - Paper 4

Paper code: Name of the Paper: Advanced Python Programming   Credit: 3

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

…………………………………………………………………………………………………

Course Objectives

1. To understand the tokens of Python.

2. To learn Multithreading in Python.

3. To know about built in Web services

4. To learn about the concept of Array.

5. To understand how to Visualization.

Course Outcomes

1. After studied unit-1, the student will be able to write simple Python programs gives basic knowledge.

2. After studied unit-2, the student will be able to understand Multithreading

3. After studied unit-3, the student will be able to create web services.
4. After studied unit-4, the student will be able to understand array.
5. After studied unit-5, the student will be able to visualization.

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: GENERATORS, ITERATOR, DECORATOR　　　　　　　　**Teaching Hours: 8 Hrs.**

Working with yield keyword, Difference between yield and return, Decorating a function with another function
Lambda Functions: Difference between def and lambda functions, Working with filter functions, Working with map functions, Working with reduce functions, List Comprehensions, Serialization, Partial Functions, Code Introspection, Closures

Unit-2: MULTITHREADING　　　　　　　　　　　　　**Teaching Hours: 8 Hrs.**

Multithreading Introduction-Multithreading methods N Deamon Thread- Inter Thread Communication by Using Event N Condition-Inter Thread Communication By Using Queue Networking: Socket, Simple Server, Simple Client, Retrieving web pages using urllib, Parsing HTML using regular Expression and Beautiful Soup, Sending Email,

Unit-3:WEB SERVICES　　　　　　　　　　　　　　**Teaching Hours: 8 Hrs.**

　　　Web Services: Parsing XML, JSON, Application Programming Interfaces

Unit-4: LIBRARY PROCESSING　　　　　　　　　　　**Teaching Hours: 7 Hrs.**

　　　NumPy Libraries for Arrays, Pandas Library for Data Processing

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

　Matplotlib for Visualization, Seaborn Library for Visualization, Scipy Library for Statistics

Internal Assessment Methods: (The following items may be brought under test, seminar andassignment 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 coursestudy 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 begiven 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. Wesley J Chun, Core Python Applications Programming, 3rd Edition. Pearson
2. Michael Bowles, Machine Leaning in Python, Essential techniques for predictive analysis, Wiley
3. Al Sweigart, "Automate the Boring Stuff with Python", 1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)

Reference Books:

1. Mark Pilgrim, Dive into Python: Python Novice to pro (source:

   http://diveintopython.org/.)

2. Alex Martelli, Python Cookbook, O'REILLY

3. Luke Sneeringer, Professional Python, WROX

4. Laura Cassell, Python Projects, WROX
5. Shai Vaingast, Beginning Python Visualization , Crafting Visual Transformation Scripts, Apress

E - REFERENCES

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

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

onwardsSemester: IV   Paper type: Core Practical - Practical 4

Paper code: Name of the Paper: Advanced Python Programming Lab   Credit: 3

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

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Course Objectives

1. To understand the tokens of Python.

2. To learn Multithreading in Python.

3. To know about built in Web services

4. To learn about the concept of Array.

5. To understand how to Visualization.

Course Outcomes

1. The student will be able to write simple Python programs gives basicknowledge.

2. The student will be able to understand Multithreading

3. The student will be able to create web services.

4. The student will be able to understand array.

5. The student will be able to visualization.

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.   Write a program using generator function.

2.   How to call same function with decorator and without decorator.

3.   Create Thread using Threading Module.

4.   Multi-Threading Priority Queue

5. Implement a program using Socket.

6. Implement a program using Urllib

7. Sending Email

8. Construct an XML formatted data and Write Python Program to Parse that XML data.

9. Construct a JSON formatted data and Write Python Program to Parse that XML data.

10. Accessing Array index using NumPy

11. Aggregation function using NumPy.

12. Implement

- Matplotlib

- Seaborn

- SciPy

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

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

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Bachelor of Artificial Intelligence) – 2022-2023 onwards

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

Paper code: Name of the Paper: Statistical Methods And Their Applications II   **Credit: 3**

Total Hours per Week: 4 Hrs.   **Lecture Hours: 52 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:   **Teaching Hours: 11 Hrs.**

Curve fitting by the methods of least squares -

$Y = a x + b$, $Y = a x^2 + b x + c$, $Y = a x^b$, $Y = a e^{bx}$ and $Y = ab^x$

.

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

Sample Space - events - probability - Addition and Multiplication Theorem - conditional probability -Baye's Theorem. Mathematical expectation Addition and Multiplication theorem, Chebychev's Inequality.

Unit-3:   **Teaching Hours: 10 Hrs.**

Standard distributions - Binomial, Poisson, Normal distribution and fitting of thesedistributions.

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

Test of Significance- small sample and large sample test based on mean, S.D. correlation and proportion - confidence interval.

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

Analysis of variance - One and Two way classifications - Basic principle of design of Experiments - Randomisation, Replication and Local control - C.R.D., R.B.D. and L.S.D.

Internal Assessment Methods: (The following items may be brought under test, seminar andassignment 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 coursestudy 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 begiven 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 adoptedby 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:

Reference Books:

1. Fundamental of Mathematical Statistics - S.C. Gupta & V.K. Kapoor - Sultan Chand

2. Fundamental of Applied Statistics - S.C. Gupta & V.K. Kapoor – Sultan Chand

3. Statistical Methods - Snedecor G.W. & Cochran W.G. oxford & +DII

4. Elements of Statistics - Mode . E.B. – Prentice Hall

Mapping with Programme Outcomes

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

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

Semester: IV   **Paper type: Allied II – Practical 3**

Paper code: **Name of the Paper: Physics**   **Credit: 2**

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

………………………………………………………………………………………………

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

LIST OF PRACTICAL EXCERCISES (Any 12 Experiments only)

1. Formation of uni-variate and bi-variate frequency distribution

2. Diagrams and Graphs

3. Measures of Location

4. Measures of Dispersion

5. Skewness and Kurtosis

6. Correlation and Regression

7. Curve Fitting : $y = ax+b$, $y=ax^2+bx+c$, $y=ax^b$, $y=ae^{bx}$

8. Fitting of distributions - Binomial, Poisson, Normal

9. Test of significance small sample and large sample tests

10. Analysis of Variance: one way classification, Two way classification and Design of Experiments - C.R.D, R.B.D & L.S.D

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.

Textbooks:

Reference Books:

1. Statistical Methods by S.P. Gupta, Sultan chand & Sons

2. Fundamental of Applied Statistics - S.C. Gupta & V.K. Kapoor

Mapping with Programme Outcomes

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

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

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Bachelor of Artificial Intelligence) – 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: …..

………………………………………………………………………………………………

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: WWW AND WEB BROWSER   **Teaching Hours: 5 Hrs.**

Internet Technology and Protocol: 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 PUBLSHING   **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&Worldwide**

    Web- How toProgram.[Third Edition].PHL,New Delhi.

2. Comdex.2000.**Teachyourselfcomputersandtheinternetvisually**.[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)

Semester: V   **Paper type: Core Theory – Paper 5**

Paper code: **Name of the Paper: Principles of Robotics**   **Credit: 4**

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

………………………………………………………………………………………………

Course Objectives

1. To understand the basics of robotics.

2. To learn Multithreading in Pytho.

3. To know about built in Web services

4. To learn about the concept of Array.

5. To understand how to Visualization.

Course Outcomes

1. After studied unit-1, the student will be able to write simple Python programs gives basic knowledge.

2. After studied unit-2, the student will be able to understand Multithreading

3. After studied unit-3, the student will be able to create web services.

4. After studied unit-4, the student will be able to understand array.

5. After studied unit-5, the student will be able to visualization.

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: HISTORY OF ROBATS   **Teaching Hours: 15 Hrs.**

Brief History-Types of Robot-Technology-Robot Classifications and specifications-Design and control issues-Various manipulators-Sensors-work cell-Programming languages.

Unit-2: ROBAT REPRESENTATION   **Teaching Hours: 16 Hrs.**

Mathematical representation of Robots-Position and Orientation-Homogeneous transformation-Various joints-Representation using the Denavit Hattenberg parameters-Degrees of Freedom- Direct kinematics-Inverse Kinematics-SCARA robots-Solvability-Solution methods-Closed form solution.

Unit-3: ROBAT OPERATIONS   **Teaching Hours: 15 Hrs.**

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints-Inverse- Wrist and arm singularity-Static analysis-Force and moment Balance.

Unit-4: ROBAT TECHNIQUES   **Teaching Hours: 16 Hrs.**

Definition-Joint space techniques-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique-Parametric descriptions-Straight line and circular paths-Position and orientation planning.

Unit-5: ROBATIC CONTROLS   **Teaching Hours: 16 Hrs.**

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model-Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

Internal Assessment Methods: (The following items may be brought under test, seminar andassignment 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. " R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.

2. John J.Criag, Introduction to Robotics Mechanics and Control, Third Edition, Pearson Education, 2009.

3. M.P.Groover, M.Weiss, R.N.Nageland N.G.Odrej, Industrial Robotics, McGraw-Hill, Singapore, 1996.

Reference Books:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford University

Press, Sixth Impression, 2010.

2. K.K.Appu Kuttan, Robotics, I K Intenational, 2007.

3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.

4. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied

Publishers, Chennai, 1998.

5. S.Ghoshal, Embedded Systems and Robotics-Projects using the 8051 Microcontroller

Cengage Learning, 2009.

Mapping with Programme Outcomes

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

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

Semester: V   Paper type: Core Theory – Paper 6

Paper code: Name of the Paper: R Programming   Credit: 4

Total Hours per Week: 6 Hrs. Lecture Hours: 78 Hrs. 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 study I/O management, File system and Mass Storage Structure .

5. To learn the basics of UNIX, LINUX systems and perform administrative tasks on LINUX servers.

Course Outcomes

1. After studied unit-1, the student will be able to learn operating system structure and services.

2. After studied unit-2, the student will be able to Enrich the process scheduling skills.

3. After studied unit-3, the student will be able to know about memory allocation.

4. After studied unit-4, the student will be able to understand disk structure and allocation methods.

5. After studied unit-5, the student will be able to understand LINUX system.

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 AND PRELIMINARIES   **Teaching Hours: 16 Hrs.**

The R Environment, R and statistics, R Commands, Data permanency and removing objects, Simple manipulations, Numbers and Vectors, Objects- modes and attributes, Ordered and unordered Factors, Arrays and Matrices

Unit-2: LISTS AND DATA FRAMES   **Teaching Hours:16 Hrs.**

Constructing and modifying lists, Making Data frames, attach( ) and detach( ), Working with data frame, Reading data from files using read.table( ), scan( ), Grouping, Conditional execution: if statements, Repetitive execution: for loops, repeat and while loops, Functions.

Unit-3: DATA EXPLORATION AND DATA HANDLING   **Teaching Hours: 15 Hrs.**

Data Exploration for Univariate and Bivariate Data -Univariate Data - Handling categorical data and numerical data using R, Bivariate Data-Handling bivariate categorical data using R, Categorical vs. Numerical, Numerical vs. Numerical

Unit-4: DATA EXPLORATION AND MANUPUATION   **Teaching Hours: 16 Hrs.**

Data Exploration for Multivariate Data-Multivariate Data -Storing multivariate data in R data frames, Accessing and manipulating data in R data frames, view multivariate data, apply( ) family functions - apply( ), sapply(), lapply( ), tapply( ), *dplyr* package- select( ), filter( ), arrange( ), rename( ), mutate( ), group_by( ), %>%, summarize( ).

Unit-5: DATA SISUVALIZATION AND CORRELATION   **Teaching Hours: 15 Hrs.**

Correlation and Data Visualization Pearson correlation, Spearman rank correlation *lattice* package in R - 1D, 2D, 3D plots using lattice *ggplot2* package in R- 1D, 2D, 3D plots using ggplot2

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. W. N. Venables, D. M. Smith, An Introduction to R, R Core Team, 2018.

2. John Verzani, simpleR – Using R for Introductory Statistics, CRC Press, Taylor & Francis Group, 2005.

Reference Books:
1. Seema Acharya, Data Analytics Using R, CRC Press, Taylor & Francis Group, 2018.
2. Michael Lavine, Introduction To Statistical Thought, Orange Grove Books, 2009.
3. Paul Teetor, R Cookbook, O'Reilly, 2011

Mapping with Programme Outcomes

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

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

Semester: III   **Paper type: Core Theory – Paper 7**

Paper code: Name of the Paper: Artificial Intelligence and Knowledge Representation   **Credit: 3**

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

……………………………………………………………………………………………………

Course Objectives

1. To understand basics of artificial neural network.

2. To understand basics of problem solving methods.

3. To understand and develop objects and reasoning in AI

4. To understand the basic concepts of fuzzy logic.

5. To understand the concepts of speech recognition.

Course Outcomes

1. After studied unit-1, the student will be able to understand the concepts of artificial neural network

2. After studied unit-2, the student will be able to understand the concepts of problem solving methods

3. After studied unit-3, the student will be able to understand the objects and reasoning in AI.

4. After studied unit-4, the student will be able to understand the concepts of fuzzy logic.

5. After studied unit-5, the student will be able to understand the concepts of speech recognition.

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 ARTIFICIAL INTELLIGENCE   **Teaching Hours: 10 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: 10 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: 11 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: 11 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: BACKTRACKING & BRANCH AND BOUND   **Teaching Hours: 10 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)

- 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:

3. "Artificial Intelligence", Elaine Rich, Kevin Knight, Tata McGraw Hill, II Edition.

4. "Artificial Intelligence: A Modern Approach," Stuart Russell, Peter Norvig, Third Edition, Prentice Hall of India, New Delhi, 2010.

5. "Prolog: Programming for Artificial Intelligence", I. Bratko, Addison – Wesley Educational Publishers Inc., Fourth edition 2011.

Reference Books:

4. "Machine Learning for Beginners 2019", Matt Henderson, This Is Charlotte, 2019

5. "Introduction to Artificial Intelligence and Expert Systems", Dan W. Patterson, Pearson, 2015

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	S	S	S	S	S	S	S	S
CO3	S	M	M	S	M	M	S	M	S	S
CO4	S	S	M	S	M	M	M	S	S	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)

Semester: V   Paper type: Core Practical –5

Paper code: Name of the Paper: Robotics Laboratory   Credit: 3

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

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Course Objectives

1. To understand basics of accuracy, repeatability and resolution .
2. To learn how to write a program for shape identification.
3. To learn how to write a program for multi process
4. To learn how to write a program for industrial process.
5. To learn how to write a program for colour identifications.

Course Outcomes

1. The students are able to understand the concept of accuracy and resolution.

2. The students are able to understand the concept of shape identifications

3. The students are able to understand the concept of multi processes

4. The students are able to understand the concept of industrial process

5. The students are able to understand the concept of color identifications

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. Estimation of accuracy, repeatability and resolution
2. Determination of maximum and minimum position of links
3. Robot Programming and Simulation for Pick and Place
4. Robot Programming and Simulation for Colour identification
5. Robot Programming and Simulation for Shape identification
6. Robot Programming and Simulation for writing practice
7. Robot Programming and Simulation for multi process
8. Robot Programming and Simulation for industrial process (Packaging, Assembly)

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

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

Semester: V   Paper type: Core Practical – practical 6

Paper code: Name of the Paper: R Programming Lab   Credit: 3

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

………………………………………………………………………………………………

Course Objectives

1. To understand basics of numbers and vectors.

2. To learn how to write a program for Array and matrices.

3. To learn how to write a program for Bi variety category data

4. To learn how to write a program for 1D, 2D, 3D plots.

5. To learn how to write a program correlations.

Course Outcomes

6. The student are able to understand the basic concept of numbers and vectors

7. The student are able to understand the concept of array and matrices

8. The student are able to understand the concept of Bi variety category matrices

9. The student are able to understand the basic concept 1D, 2D, 3D

10.   The student are able to understand the concept of correlations

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. Demonstrate the usage of Numbers and Vectors in R

2. Simple manipulations on Numbers and Vectors, Objects-modes and attributes, Ordered and unordered Factors

3. Implement the concepts of Arrays and Matrices

4. Demonstrate the usage of Data Frames and Lists and its attributes -attach, detach, scan and importing a file

5. Implement the concept of grouping and conditional execution on Data Frames and Lists

6. Demonstrate repetitive executions on DataFrames

7. Use a Dataset to handle the Categorical and numerical data

8. Use a Dataset to handle the Bi-variate categorical data

9. Use a Dataset to handle the Multivariate categorical data

10. Demonstrate the usage of apply() functions.

11. Implement the usage of dplyr package

12. Utilize a lattice package to plot 1D, 2D and 3D plots for a given dataset.

13. Utilize ggplot2 package to plot 1D, 2D and 3D plots for a given dataset.

14. Demonstrate Pearson correlation and Spearman rank correlation.

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.

Mapping with Programme Outcomes

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

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

Semester: V   Paper type: Internal Elective – Paper 1

Paper code: Name of the Paper: Fuzzy Logic and Neural Networks   Credit: 3

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

……………………………………………………………………………………………………

Course Objectives

1. To learn the basic concept of Fuzzy Logics and its controls

2. To understand the concept of adaptive fuzzy logic system

3. To understand the concept of artificial neural networks with its algorithm

4. To understand the concept of Mapping

5. To learn from the case studies of fuzzy logic system

Course Outcomes

1. After studied unit-1, the students are able to understand the concept of fuzzy logics.

2. After studied unit-2, the students are able to understand the concept of adaptive fuzzy logic system

3. After studied unit-3, the students are able to understand the concept of neural networks

4. After studied unit-4, the students are able to understand the concept mapping

5. After studied unit-5, the students are able to understand the concept of fuzzy logic system.

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: FUZZY SET THEORY AND FUZZY LOGIC CONTROL **Teaching Hours: 8 Hrs.**

Basic concepts of fuzzy sets-Operations on fuzzy sets-Fuzzy relation equations-Fuzzy logic control Fuzzification-Defuzzification-Knowledge base-Decision making logic-Membership functions-Rule base.

Unit-2: ADAPTIVE FUZZY SYSTEMS **Teaching Hours: 8 Hrs.**

Performance index-Modification of rule base()-Modification of membership functions- Simultaneous modification of rule based and membership functions-Genetic algorithms- Adaptive fuzzy system-Neuro fuzzy systems.

Unit-3: ARTIFICIAL NEURAL NETWORKS **Teaching Hours: 8 Hrs.**

Introduction-History of Neural Networks-Multilayer Perceptions-Back propagation algorithm and its Variations-Different types of learning, examples.

Unit-4: MAPPING AND RECURRENT NETWORKS **Teaching Hours: 8 Hrs.**

Counter propagation-Self organization Map-Cognitron and Neocognitron-Hopfield Net- Kohonnen Nets-Grossberg Nets-Art-I, Art-II reinforcement learning

Unit-5: CASE STUDIES **Teaching Hours: 7 Hrs.**

Application of fuzzy logic and neural networks to Measurement-Control-Adaptive Neural Controllers-Signal Processing and Image Processing

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. Vallum B.R and Hayagriva V.R C++, Neural networks and Fuzzy logic, BPB Publications, New Delhi, 1996

Reference Books:
1. Fuzzy logic and Neural Networks/Chennakesava R.Alavala/New Age International, 2008

2. Neural Networks for control, Millon W.T, Sutton R.S and Werbos P.J, MIT Press 1992

3. Fuzzy sets Fuzzy logic, Klir, G.J and Yuan B.B Prentice Hall of India Pvt. Ltd, New Delhi

4. Neural Networks and Fuzzy Systems, Kosko, Prentice hall of India Pvt Ltd, New Delhi, 1994

5. Introduction to Artificial Neural Systems, Zurada J.M.Jaico Publishing House, New Delhi,1994

Mapping with Programme Outcomes

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

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

Semester: V   Paper type: Skill Based Subject – Paper 3

Paper code: Name of the Paper: Relational Database Management System   Credit: 2

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

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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. Describe the database architecture and its applications Sketch the ER diagram for real world applications Uses various ER diagram for a similar concepts from various sources.
2. 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. Describe the various normalization forms Apply the normalization concepts for a table of data Practices a table and implement the normalization concepts.
4. Explain the storage and accessing of data.
5. Illustrate the query processing in database management. Define the concurrency control and deadlock concept

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: DATABASE ARCHITECTURE AND ER DIAGRAM   **Teaching Hours: 8 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 modeling: entity types, entity set, attribute and key, relationships, relation types, roles and structural constraints, weak entities, enhanced E-R and object modeling, sub classes; super classes, inheritance, specialization and generalization

Unit-2: RELATIONAL DATA MODEL   **Teaching Hours: 8 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 QueriesModification Of Database-Joined Relations-DDL-Embedded SQL-Dynamic SQL-Other SQL Functions- -Integrity and Security.

Unit-3: DATA NORMALIZATION   **Teaching Hours: 7 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: 8 Hrs.**

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

Unit-5: QUERY PROCESSING AND TRANSACTION MANAGEMENT   **Teaching Hours: 8 Hrs.**

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

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.
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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. 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.

Reference Book:
1. Bipin Desai, An Introduction to database systems, Galgotia Publications, 2010. 2. Ramez Elamassri, Shankant B-Navathe, Fundamentals of Database Systems, Pearson, 7th Edition, 2015

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	M	M	S	S	M	S
CO2	S	S	S	M	M	S	M	S	S	S
CO3	S	M	M	S	M	M	M	S	S	S
CO4	S	S	M	M	S	S	S	M	M	M
CO5	S	M	M	S	M	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
(Bachelor of Artificial Intelligence) – 2022-2023 onwards

Semester: VI   **Paper type: Core Theory – Paper 8**

Paper code: **Name of the Paper: MACHINE LEARNING TECHNIQUES**   **Credit: 4**

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

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Course Objectives

1. To understand basic concept of machine learning,
2. To understand concept of supervised learning
3. To understand to identify unsupervised data and how to process it.
4. To understand the basic concepts of learning and its type.
5. To understand how to represent data.

Course Outcomes

1. After studied unit-1, the student will be able to understand the concepts of machine learning
2. After studied unit-2, the student will be able to understand the concepts of supervised learning.
3. After studied unit-3, the student will be able to understand the concepts of Unsupervised learning.

4. After studied unit-4, the student will be able to understand the concepts of learning with its type.

5. After studied unit-5, the student will be able to understand the concepts of representation of data.

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

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 MACHINE LEARNING   **Teaching Hours: 11 Hrs.**

Definition of Machine Learning - Understanding Objectives of Machine Learning - Various Components of Machine Learning – Data Storage – Data Processing – Deriving Variables – Transformation – Generalization – Sampling –Features of Machine Learning – Types of Machine Learning– Supervised – Unsupervised – Reinforcement Learning - Techniques and Predictive Models – Deployment of Solution – Strategic Solution

Unit-2: SUPERVISED LEARNING   **Teaching Hours: 10 Hrs**.

Classification and Regression, **Generalization, Overfitting, and Underfitting** : Relation of Model Complexity to Dataset Size . **Supervised Machine Learning Algorithms** : Some Sample Datasets, k-Nearest Neighbours, Linear Models Naive Bayes Classifiers, Decision Trees , Support Vector Machines , **Uncertainty Estimates from Classifiers** :The Decision Function , Predicting Probabilities , Uncertainty in Multiclass Classification.

Unit-3: UNSUPERVISED LEARNING AND PREPROCESSING   **Teaching Hours: 10 Hrs.**

Types of Unsupervised Learning, Challenges in Unsupervised Learning. **Reprocessing and Scaling**: Different Kinds of pre-processing , Applying Data Transformations, Scaling Training and Test Data the Same Way, The Effect of Reprocessing on Supervised Learning,

Unit-4: DIMENSIONALITY REDUCTION, FEATURE EXTRACTION, AND MANIFOLD LEARNING   **Teaching Hours: 11 Hrs.**

Principal Component Analysis (PCA), Non-Negative Matrix Factorization (NMF), Manifold Learning with t-SNE, **Clustering:** k-Means Clustering, Agglomerative Clustering, DBSCAN, Comparing and Evaluating Clustering Algorithms, Summary of Clustering Methods.

Unit-5: REPRESENTING DATA AND ENGINEERING FEATURES   **Teaching Hours: 10 Hrs.**

Categorical Variables: One- Hot-Encoding (Dummy Variables), Numbers Can Encode Categorical, Binning, Discretization, Linear Models, and Trees , **Automatic Feature Selection** : Univariate Statistics, Model-Based Feature Selection, Iterative Feature Selection, Utilizing Expert Knowledge

Internal Assessment Methods: (The following items may be brought under test, seminar andassignment 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. Andreas C. Müller & Sarah Guido, "Introduction to Machine Learning with Python A Guide For Data Scientists" O'Reilly book, 2017
2. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2005.

Reference Books:
1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning" (2nd ed).Springer, 2008.
3. Stephen Marsland, "Machine Learning –An Algorithmic Perspective", CRC Press, 2009.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	M	S	S	S	S
CO2	S	S	M	S	S	M	S	S	S	S
CO3	S	M	M	S	S	M	S	M	S	S
CO4	S	S	M	S	M	M	S	M	S	S
CO5	S	M	M	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
(Bachelor of Artificial Intelligence) – 2022-2023 onwards

Semester: VI   **Paper type: Core Theory– Paper 9**

Paper code: **Name of the Paper: NATURAL LANGUAGE PROCESSING**   **Credit: 4**

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

……………………………………………………………………………………………………

Course Objectives

1. To understand basic techniques of NLP and its problems,

2. To understand concept of lexical analysers.

3. To understand to grammars with its level.

4. To understand the basic concepts of semantic networks.

5. To understand the concept of natural languages.

Course Outcomes

1. After studied unit-1, the student will be able to understand the concepts NLP and its problems
2. After studied unit-2, the student will be able to understand the concepts of lexical analysers.
3. After studied unit-3, the student will be able to understand the concepts of grammars.

4. After studied unit-4, the student will be able to understand the concepts of semantic networks.

5. After studied unit-5, the student will be able to understand the concepts of natural languages.

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 NLP   **Teaching Hours: 11 Hrs.**

Application of NLP techniques and key issues-MT grammar checkers-dictation-document generation-NL interfaces-Natural language processing key issues-the different analysis level used for NLP: morpho-lexical-syntactic-semantic-pragmatic-markup (TEI, UNICODE)-finite state automata-Recursive and augmented transition networks-open problems.

Unit-2: LEXICAL LEVEL   **Teaching Hours: 10 Hrs.**

Error tolerant lexical processing (spelling error correction)-transducers for the design of morphologic analyzers features-towards syntax: part-of-speech tagging (BRILL,HMM)-efficient representations for linguistic resources (lexica,grammars,..)tries and finite state automata.

Unit-3: SYNTACTIC LEVEL   **Teaching Hours: 11 Hrs.**

Grammars (Eg: Formal/Chomsky hierarchy,DCSGs, systematic case, unification, stochastic)-parsing(top-down,bottom up, char(early algorithm), CYK algorithm)-automated estimation of probabilistic model parameters (inside-outside algorithm)-data oriented parsing-grammar formalisms and treebanks-efficient parsing for context-free grammars (CFGs)-statistical parsing and probabilistic CFGs (PCFGs)-lexicilized PCFGse.

Unit-4: SEMANTIC LEVEL   **Teaching Hours: 10 Hrs.**

Logical forms-ambiguity resolution-semantic network and parsers-procedural semantics-montague semantics-vector space approaches-distributional semantics-lexical semantics and word sense disambiguation-compositional semantics semantic role labeling and semantic parsing.

Unit-5: PRAGMATIC LEVEL   **Teaching Hours: 10 Hrs.**

Knowledge representation-reasoning-plan/goal recognition-speech acts/intentions-belief models-discourse-reference. Natural language generation: Content determination-sentence planning-surface realization, subjectivity and sentiment analysis: information extraction-automatic summarization-information retrieval and question answering-named entity recognition and relation extraction-IE using sequence labeling-machine translation: Basic issues in MT-statistical translation-word alignment-phrase based translation and synchronous grammars.

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. Daniel J and James H.Martin, "Speech and Language Processing", An introduction to Natural Language Processing, Computational Linguistic and Speech Recognition", Prentice Hall, 2009.

Reference Books:
1. Lan H Written and Elbef, MarkA.Hall", Data Mining: Practical Machine Learning tools and Techniques", Morgan Kaufmann, 2013.

Mapping with Programme Outcomes

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

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

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

Paper code: Name of the Paper: Machine Learning Lab   Credit: 3

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

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Course Objectives

1. To understand basic concept of machine learning,
2. To understand concept of ID3 Algorithm
3. To understand to support vector network.
4. To understand the basic concepts of K means algorithm.
5. To understand the basic concept of linear regression

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

11.   The student are able to understand the basic concept of machine learning

12.   The student are able to understand the concept of ID3 algorithm

13.   The student are able to understand the support vector network

14.   The student are able to understand the basic concept of K means algorithm

15.   The student are able to understand the concept of linear regression.

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

a. Loading the data from a given csv file into a data frame and print the shape of the data, type of the data, number of rows-columns, feature names and the description.

b. Get the number of observations, missing values and nan values for the given data set.

c. Linear regression

d. K Nearest Neighbour

e. ID3 algorithm.

f. Naïve Bayesian classifier

g. Support vector machine

h. Bayesian network

i. PCA

j. K-Means Algorithm

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

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

ii. Data collection and paper writing practices: books level, field study level. Using the coursestudy for society and nature development – exercise

iii. Workshops, preparing technical term dictionaries from text books and reference books.

iv. Preparing question paper by the candidates: objective type, descriptive type, training can begiven by the teacher

v. Forming digital library: collecting text and reference books, course material.

vi. 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.

vii. Extracurricular and cultural activities may be framed through the syllabus content.

viii. Grouping students for self discussion, self learning process.

ix. 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.

xi. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovativemethods may be implemented in the practices and report can be written for documentation, further discussion and research.

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

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

xiv. 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 Artificial Intelligence) – 2022-2023 onwards

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

Paper code: Name of the Paper: Natural Language Processing Lab   Credit: 2

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

………………………………………………………………………………………………

Course Objectives

1.   To understand basic techniques of NLP and its problems,

2.   To understand concept of lexical analysers.

3.   To understand to grammars with its level.

4.   To understand the basic concepts of semantic networks.

5. To understand the concept of natural languages.

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

1. The student are able to understand the basic concept of NLP problems

2. The student are able to understand the concept of lexical analysers

3. The student are able to understand the concept of grammar with its level

4. The student are able to understand the basic concept of semantic networks

5. The student are able to understand the concept of natural language

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. Implementing word similarity
2. Word Analysis
3. Word Generation
4. N-Grams
5. Implementing simple problems related to word disambiguation
6. Simple demonstration of part of speech tagging
7. Lexical Analyzer
8. Semantic Analyzer

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.
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i. Following institution and intellectual and writing reports in the course field.
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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.

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)

Semester: VI   Paper type: Internal   Elective – Paper 2

Paper code: Name of the Paper: Computer Organization   Credit: 3

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

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Course Objectives

1. To understand the basics of Number System.

2.   To understand the concept of Simplification of Boolean expressions using K-map and arithmeticcircuits.

3. To understand the concept of Combinational Logic Circuits

4. To understand the concept of Basic Structure of Computers

5. To understand the basic concepts of Input Output and Memory Organization

Course Outcomes

1.   After studied unit-1, the student will be able to understand Boolean algebra and basic gates.

2.   After studied unit-2, the student will be able to understand how to simplify expression using K-Map.

3.   After studied unit-3, the student will be able to understand how to build combinational circuits.

4.   After studied unit-4, the student will be able to know about registers and addressing modes

5.   After studied unit-5, the student will be able to understand types of memories.

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: ORGANIZATION AND DESIGN   **Teaching Hours: 7 Hrs.**

Instruction Codes - Computer Registers - Computer Instructions – Timing and Control – Instruction Cycle - Memory Reference Instructions – Input-Output and Interrupts.

Unit-2: COMPUTER PROGRAMMING   **Teaching Hours: 8 Hrs.**

Introduction - Machine language - Assembly language - The assembler - Program loops - Programming arithmetic and logical operation – Subroutines - Input-output programming.

Unit-3: BIG DATA FROM DIFFERENT PERSPECTIVES   **Teaching Hours: 8 Hrs.**

Control Memory – Address Sequencing – Micro program Examples – Design of Control Unit.

Unit-4: HADOOP AND MAP REDUCE   **Teaching Hours: 8 Hrs.**

Introduction – General Register Organization – Stack Organization – Instruction Formats – Addressing Modes.

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

Parallel Processing – Pipelining - Arithmetic pipeline - Instruction pipeline - Vector Processing - Array Processor.

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. Morris Mano M. "Computer System Architecture". New Delhi: Prentice Hall of India Private Limited, 2011

Reference Books:
1. William Stallings. "Computer Organization and Architecture". 8th edition. Pearson Publication, 2010
2. Morris Mano. "Digital Login and Computer Design". New Delhi: Prentice Hall of India Private Limited, 2001.

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
(Bachelor of Artificial Intelligence) – 2022-2023 onwards

Semester: VI   **Paper type: Internal Elective – Paper 3**

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

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

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

5. To learn the basics of UNIX, LINUX systems and perform administrative tasks on LINUX servers.

Course Outcomes

1. After studied unit-1, the student will be able to learn operating system structure and services.

2. After studied unit-2, the student will be able to Enrich the process scheduling skills.

3. After studied unit-3, the student will be able to know about memory allocation.

4. After studied unit-4, the student will be able to understand disk structure and allocation methods.

5. After studied unit-5, the student will be able to understand LINUX system.

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

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: OPERATING SYSTEM BASICS   **Teaching Hours: 7 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 SCHEDULING ALGORITHM AND PREVENTION   **Teaching Hours: 8 Hrs.**

Introduction –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: STORAGE MANAGEMENT   **Teaching Hours: 8 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: I/O SYSTEMS   **Teaching Hours: 8 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: CASE STUDIES   **Teaching Hours: 8 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" – William 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 Publishing Co., 2001.
3. "Fundamentals of Operating System", Prof. R. Sriddhar, Dynaram Publication, Bangalore Company.

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)

(Bachelor of Artificial Intelligence) – 2022-2023 onwards

Semester: VI   Paper type: Skill Based subject – Paper 4

Paper code: Name of the Paper: ETHICAL HACKING   Credit: 2

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

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Course Objectives

1. To understand basic concept of hacking

2. To understand concept of Scanning and enumeration

3. To learn how to program for hacking.

4. To understand the fundamentals of security.

5. To understand the concept of testing and its tools.

Course Outcomes

1. After studied unit-1, the student will be able to understand the concepts of hacking
2. After studied unit-2, the student will be able to understand the concepts of scanning and enumeration
3. After studied unit-3, the student will be able to understand the concepts of hacking

4. After studied unit-4, the student will be able to understand the concepts of security.

5. After studied unit-5, the student will be able to understand the concepts of testing and its tools.

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 HACKING   **Teaching Hours: 7 Hrs.**

Importance of Security-Elements of Security-Phases of an Attack-Types of Hacker Attacks-Hacktivism-Vulnerability Research-Introduction to Footprinting-Information Gathering Methodology-Footprinting Tools-WHO IS Tools-DNS Information Tools-Locating the Network Range-Meta Search Engines.

Unit-2: SCANNING AND ENUMERATION   **Teaching Hours: 8 Hrs.**
Introduction to Scanning-Objectives-Scanning Methodology-Tools-Introduction to Enumeration –Enumeration Techniques –Enumeration Procedures-Tools

Unit-3: SYSTEM HACKING   **Teaching Hours: 8 Hrs.**:
Introduction-Cracking Passwords-Password Cracking Websites-Password Guessing-Password Cracking Tools-Password Cracking Counter measures-Escalating Privileges-Executing Applications-Keyloggers and Spyware.

Unit-4: PROGRAMMING FOR SECURITY PROFESSIONALS

Teaching Hours: 8 Hrs.
Programming Fundamentals- C Language-HTML-PERL-Windows OS Vulnerabilities-Tools for Identifying Vulnerabilities-Counter measures-Linux OS Vulnerabilities –Tools for Identifying Vulnerabilities-Counter measures.

Unit-5: PENETRATION TESTING   **Teaching Hours:8Hrs.**

Introduction-Security Assessments-Types of Penetration Testing-Phases of Penetration Testing-Tools-Choosing Different Types of Pen-Test Tools-Penetration Testing Tools.

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. " EC-Council, "Ethical Hacking and Countermeasures:Attack Phases", Cengue Learning,2010
2. Jon Erikson,"Hacking, 2nd Edition:The Art of Exploitation", No starch Press Inc, 2008
3. Michael T.Simpson, Kent Backman, James E.Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learniing, 2013.

Reference Books:
1. Patrick Engebretson,"The Basics of Hacking and Penetration Testing-Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
2. Rafay Boloch,"Ethical Hacking and Penetration Testing Guide", CRC Press, 2014

Mapping with Programme Outcomes

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

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