B.Sc., COMPUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

SYLLABUS

FROM THE ACADEMIC YEAR

2026 - 2027

MANONMANIAM SUNDARANAR UNIVERSITY,
Tirunelveli – 627 012

Manonmaniam Sundaranar University, Tirunelveli

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM

OPERATIONAL GUIDELINES FOR FRAMING CURRICULUM

A. VISION AND MISSION OF THE UNIVERSITY

Vision

"To provide quality education to reach the un-reached"

Mission

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

B. PREAMBLE

The Bachelor of Science in Computer Science with Artificial Intelligence and Machine Learning (B.Sc. CS with AI & ML) programme is designed to provide students with a strong foundation in Computer Science while equipping them with advanced knowledge and practical skills in the rapidly evolving domains of Artificial Intelligence (AI) and Machine Learning (ML). The programme addresses the growing demand for skilled professionals capable of developing intelligent systems, automating complex processes, and deriving meaningful insights from large volumes of data.

The curriculum integrates fundamental areas of Computer Science, including programming, data structures, algorithms, database management systems, operating systems, software engineering, and computer networks, with specialized courses in Artificial Intelligence, Machine Learning, Deep Learning, Data Science, Computer Vision, and Intelligent Systems. The programme emphasizes experiential learning through laboratory work, mini-projects, internships, industry interactions, and capstone projects that enable students to apply theoretical concepts to real-world challenges.

The programme aims to cultivate analytical thinking, problem-solving abilities, innovation, creativity, and ethical responsibility in the development and deployment of intelligent technologies. Students are encouraged

to explore emerging technologies, engage in interdisciplinary learning, and undertake research-oriented activities that contribute to technological advancement and societal well-being.

C. PROGRAMME EDUCATIONAL OUTCOMES (PEO)

In alignment with the Vision and Mission of the University, the following have been defined as the PEO for the graduates.

PEO1: Developing strong positive attitude to learn independently the concepts in the field of study

PEO2: Ensuring confidence among the learners to apply the knowledge and skills gained to solve real life issues

PEO3: Habituating ethical values among the learners to succeed in personal and professional life

D. PROGRAMME OUTCOMES (PO)

After the successful completion of Undergraduate Programme from the University, the learner should be able to

PO1: Comprehend the knowledge acquired and communicate the same to others.

PO2: Analyze and compare the factual data / situation to comprehend and to critically evaluate to find solution to the problem ahead.

PO3: Apply theories and philosophies learned in solving the problem in scientific manner.

PO4: Think reflectively on the earlier activities and attempt for self directed lifelong learning process.

PO5: Understand multicultural existence and identify the means to prolong moral/ethical values in personal and professional life.

PO6: Expose the learner to the digital technology to learn through multiple sources

PO7: Train the learner to be a responsible player in teams and impart leadership qualities in them.

Programme Specific Outcomes (PSOs) of B.Sc. Degree Programme in Computer Science with Artificial Intelligence & Machine Learning

PSO 1 : To develop the ability to understand the basic theories and concepts in Computing, Artificial Intelligence and Machine Learning

PSO 2 : To apply fundamental concepts of Computer Science, Mathematics, Statistics, and Data Analytics to solve computational problems.

PSO 3 : To develop efficient software applications using programming languages, data structures, algorithms, and modern development tools.

PSO 4 : To analyze data and implement machine learning techniques for prediction, classification, and intelligent decision-making.

PSO 5 : To design and develop systems using Deep Learning, Neural Networks, Natural Language Processing, and Computer Vision techniques.

PSO6: To identify real-world problems and provide innovative solutions in domains such as healthcare, business, education, and smart systems.

PSO7: To demonstrate ethical practices, teamwork, leadership, communication skills, and professional responsibility in Computer Science, Artificial Intelligence & Machine Learning related careers.

RBT for evaluation

* K1 (Remember) - The learner should remember and recall facts and concepts.
* K2 (Understand) - The learner should interpret and be able to describe the concepts.
* K3 (Apply) - The learner should know to apply the acquired knowledge, facts and techniques in known / new situations.
* K4 (Analyze) - The learner should make inferences through analysis with supporting documents / actions.
* K5 (Evaluate) - The learner should make judgments based on evaluation of valid data.
* K6 (Create) - The learner should propose / identify new patterns or means to arrive at a solution / concept.

REGULATIONS/PROGRAMME SPECIFIC REQUIREMENTS

Duration of the Course:

B.Sc. Computer Science with Artificial Intelligence & Machine Learning is a 3 years full time programme spread over six semesters.

Eligibility for Admission to the Programme:

Refer (Admission guidelines 2026-27 vide TNDCE/1531/2026-M1-2 dated **07-05-2026 in www.tndce.tn.gov.in**

MEASUREMENT OF ATTAINMENT OF COURSE OUTCOME

In both Internal and Semester End Examinations

For UG - Lower Order Thinking (K1, K2, & K3) – 60 % in each part
Higher Order Thinking (K4, K5, & K6) – 40 % in each part

Scheme of Evaluation (THEORY):
Core/Elective/ Skill Enhancement Courses
Total Marks:100
(Internal:25Marks, External:75Marks)
In both Internal and Semester End Examinations

For UG - Lower Order Thinking (K1, K2, & K3) – 60 % in each part
Higher Order Thinking (K4, K5, & K6)– 40 % in each part

There is no Passing Minimum for the CIA component. But overall(CIA+ External), the student should get 40% or more to pass	
CIA-Internal Marks	**External Marks**
Average of best two tests from three: 20 Marks **Assignment: : 05 Marks**	**End Semester Examination**
Total: 25 Marks	**Total: 75 Marks**

Scheme of Evaluation (PRACTICAL):
Core / Skill Enhancement Course
Total Marks:100
(Internal:50Marks External:50Marks)

There is no Passing Minimum for the CIA component. But overall (CIA+ External), the student should get 40% or more to pass	
CIA-Internal Marks	**External Marks**
Total: 50 Marks	**Total: 50 Marks**

Scheme of Evaluation (PROJECT)
Total Marks:100
(Internal:50Marks External:50 Marks

There is no Passing Minimum for the CIA component. But overall(CIA+ External), the student should get 40% or more to get a pass	
CIA-Internal Marks	**External Marks**
Total: 50 Marks	**Total: 50 Marks**

Mapping of Course with Programme Specific Outcomes (PSOs)

No	Title of the Course	Category	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	Total Score
1.	C++ Programming	Core	3	3	3	2.5	1	3	2	17.5
2.	C++ Programming Laboratory	Core	3	3	3	2.5	1	3	2	17.5
3.	Discrete Mathematics	Elective	3	3	3	3	1	3	2	18
4.	Operations Research	Elective	3	2	2	3	3	2	2	17
5.	Office Automation Laboratory	SEC	3	3	2	2	1	2	2	15
6.	Introduction to Computers, Artificial Intelligence & Machine Learning	FC	3	3	3	3	1	2	1	16
7.	Python Programming	Core	3	3	3	2.5	1	3	2	17.5
8.	Python Programming Laboratory	Core	3	3	3	2.5	1	3	2	17.5
9.	Digital Principles	Elective	3	3	3	3	1	3	2	18
10.	Pattern Recognition	Elective	3	3	3	3	1	2	1	16
11.	Data Structures Laboratory	SEC	3	3	3	3	2	3	2	19
12.	Data Structures	SEC	3	3	3	3	1	2	1	16
13.	Java Programming	Core								
14.	Java Programming Laboratory	Core								
15.	Probability & Statistics	Elective								
16.	Graph Theory	Elective								
17.	Multimedia Laboratory	SEC								
18.	Artificial Intelligence & Machine Learning	Core								
19.	Artificial Intelligence & Machine Learning Laboratory	Core								
20.	Cyber Security	Elective								
21.	Data Analytics & Visualization	Elective								
22.	Power BI Laboratory	SEC								
23.	Database Management Systems	Core								
24.	Computer Networks & Security	Core								
25.	Gen AI for Data Science	Core								
26.	Database Management Systems Laboratory	Core								

27.	Android App Development Laboratory	Core								
28.	Mini Project	Core								
29.	Deep Learning	Elective								
30.	Distributed Operating Systems	Elective								
31.	R Programming	Core								
32.	Software Engineering	Core								
33.	R Programming Laboratory	Core								
34.	Project	Core								
35.	Bio Inspired Computing	Elective								
36.	Simulation & Modelling	Elective								
37.	Blockchain Technology	Elective								
38.	Digital Marketing	Elective								
39.	Cloud Computing	Elective								
40.	User Interface Design	Elective								
Total Score of all courses contributing to PSOs										

Level of Contribution of the course towards attaining PSOs

0 – No Contribution

1 – Low Level

2 – Medium Level

3 – High Level

Credit Distribution for UG Programmes – B.Sc CS with AI & ML

	Sem I	Cr	Ho	Sem II	Cr	Ho	Sem III	Cr	Ho	Sem IV	Cr	Ho	Sem V	Cr	Ho	Sem VI	Cr	Ho
Part – 1	Language – Tamil	3	6	Language – Tamil	3	6	Language – Tamil	3	6	Language – Tamil	3	6						
Part – 2	Language –English	3	6	Language –English	3	4	Language –English	3	6	Language –English	3	6						
Part – 3	1.3 Core Course – CC I	4	4	2.3 Core Course – CC III	4	4	3.3 Core Course – CC V	4	4	4.3 Core Course – CC VII	4	4	5.1 Core Course – CC IX	4	4	6.1 Core Course – CC XIV	4	4
	1.4 Core Course – CC II Practical	3	4	2.4 Core Course – CC IV Practical	3	4	3.4 Core Course – CC VI Practical	3	4	4.4 Core Course – CC VIII Practical	3	4	5.2 Core Course – CC X	4	4	6.2 Core Course – CC XV	4	4
													5.3 Core Course – CC XI	4	4	6.3 Core Course – CC XVI Practical	3	6
													5.4 & 5,5 Core Course – CC XII & XIII Practical	2 2	4 4	6.4 Core Course – CC XVII Major Project	3	6
													5.6 Core Course – CC XIV Mini Project	2	4	6.5 Elective - Generic Discipline – EC VI	4	4
	1.5 Elective – Generic/ Discipline – EC I	4	4	2.5 Elective – Generic/ Discipline – EC II	4	4	3.5 Elective – Generic/ Discipline – EC III	4	4	4.5 Elective – Generic/ Discipline – EC IV	4	4	5.7 Elective – Generic/ Discipline – EC V	4	4	6.6 Elective – Generic/ Discipline – EC VII	4	4
Part – 4	1.6 Skill Enhancement – SEC I Practical	3	3	2.6 Skill Enhancement – SEC II Practical	2	3	3.6 Skill Enhancement – SEC IV Practical	2	2	4.6 Skill Enhancement – SEC VI Practical	2	2	5.8 Summer Internship / Industrial Training	1				
	1.7 Foundation Course	3	3	2.7 Skill Enhancement – SEC III	2	3	3.7 E.V.S.	2	2	4.7 Value Education	2	2						
				2.8 Naan Mudhalvan Course – English	2	2	3.8 Naan Mudhalvan / Skill Enhancement – SEC V	2	2	4.8 Naan Mudhalvan / Skill Enhancement – SEC VII	2	2	5.9 Naan Mudhalvan / Skill Enhancement – SEC VIII	2	2	6.7 Naan Mudhalvan / Skill Enhancement – SEC IX	2	2
Part – 5																6.8 Extension Activity	1	-
		23	**30**		**23**	**30**		**23**	**30**		**23**	**30**		**25**	**30**		**25**	**30**
	Total – 142 Credits																	

Manonmaniam Sundaranar University, Tirunelveli

OUTCOME BASED EDUCATION (OBE)
Choice Based Credit System

UG courses – B.Sc Computer Science with Artificial Intelligence & Machine Learning – Curriculum Design

(For the academic year 2026-'27 to 2028-'29)

First Year – Semester I

	List of Courses	Credit	No. of Hours (L/T/P)
Part-1	Language – Tamil	3	6
Part-2	Language – English	3	6
Part-3	1.3 Core Course – CC I Theory – C++ Programming	4	4
	1.4 Core Course – CC II Practical – C++ Programming Laboratory	3	4
	1.5 Elective Course – EC I Theory – Discrete Mathematics / Operations Research	4	4
Part-4	1.6 Skill Enhancement Course – SEC I Practical – Office Automation Laboratory	3	3
	Foundation Course Theory – Introduction to Computers, Artificial Intelligence & Machine Learning	3	3
		23	**30**

First Year – Semester II

	List of Courses	Credit	No. of Hours (L/T/P)
Part-1	Language – Tamil	3	6
Part-2	Language – English	3	4
Part-3	2.3 Core Course – CC III Theory – Python Programming	4	4
	2.4 Core Course – CC IV Practical – Python Programming Laboratory	3	4
	2.5 Elective Course – EC II Theory – Digital Principles / Pattern Recognition	4	4
Part-4	2.6 Skill Enhancement Course – SEC II Practical – Data Structures Laboratory	2	3
	2.7 Skill Enhancement Course – SEC III Theory – Data Structures	2	3
	2.8 Naan Mudhalvan Course – English	2	2
		23	**30**

Second Year – Semester III

	List of Courses	Credit	No. of Hours (L/T/P)	Page No
Part-1	Language – Tamil	3	6	
Part-2	Language – English	3	6	
Part-3	3.3 Core Course – CC V Theory – Java Programming	4	4	
	3.4 Core Course – CC VI Practical – Java Programming Laboratory	3	4	
	3.5 Elective Course – EC III Theory – Probability & Statistics / Graph Theory	4	4	
Part-4	3.6 Skill Enhancement Course – SEC IV Practical – Multimedia Laboratory	2	2	
	3.7 Environmental Studies	2	2	
	3.8 Naan Mudhalvan / Skill Enhancement Course – SEC V	2	2	
		23	**30**	

Second Year – Semester IV

	List of Courses	Credit	No. of Hours (L/T/P)	Page No
Part-1	Language – Tamil	3	6	
Part-2	Language – English	3	6	
Part-3	4.3 Core Course – CC VII Theory – Artificial Intelligence & Machine Learning	4	4	
	4.4 Core Course – CC VIII Practical – Artificial Intelligence & Machine Learning Laboratory	3	4	
	4.5 Elective Course – EC IV Theory – Cyber Security / Data Analytics & Visualization	4	4	
Part-4	4.6 Skill Enhancement Course – SEC VI Practical – Power BI Laboratory	2	2	
	4.7 Value Based Education	2	2	
	4.8 Naan Mudhalvan / Skill Enhancement Course – SEC VII	2	2	
		23	**30**	

Third Year – Semester V

	List of Courses	Credit	No. of Hours (L/T/P)	Page No
Part-3	5.1 Core Course – CC IX Theory – Database Management Systems	4	4	
	5.2 Core Course – CC X Theory – Computer Networks & Security	4	4	
	5.3 Core Course – CC XI Theory – Gen AI for Data Science	4	4	
	5.4 Core Course – CC XII Practical – Database Management Systems Laboratory	2	4	
	5.5 Core Course – CC XIII Practical – Android App Development Laboratory	2	4	
	5.6 Core Course – CC XIV Mini Project	2	4	
	5.7 Elective Course – EC V Theory – Deep Learning / Distributed Operating Systems	4	4	
Part-4	5.8 Summer Internship / Industrial Training	1	-	
	5.9 Naan Mudhalvan / Skill Enhancement Course – SEC VIII	2	2	
		25	**30**	

Third Year – Semester VI

	List of Courses	Credit	No. of Hours (L/T/P)	Page No
Part-3	6.1 Core Course – CC XV Theory – R Programming	4	4	
	6.2 Core Course – CC XVI Theory – Software Engineering	4	4	
	6.3 Core Course – CC XVII Practical – R Programming Laboratory	3	6	
	6.4 Core Course – CC XVIII Major Project	3	6	
	6.5 Elective Course – EC VI Theory Bio Inspired Computing / Simulation & Modelling/ Block Chain Technology	4	4	
	6.6 Elective Course – EC VI I Theory – Digital Marketing / Cloud Computing / User Interface Design	4	4	
Part-4	6.7 Naan Mudhalvan / Skill Enhancement Course – SEC IX	2	2	
Part-5	6.8 Extension Activity	1	-	
		25	**30**	

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part - 1	3	3	3	3	-	-	12
Part - 2	3	3	3	3	-	-	12
Part - 3	11	11	11	11	22	22	88
Part - 4	6	6	6	6	3	2	29
Part - 5	-	-	-	-	-	1	1
Total	23	23	23	23	25	25	**142**

***Part I. II, and Part III components will be separately considered for CGPA calculation and classification for the undergraduate programme and the other components. Part IV, V must be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

First Year – Semester I
CORE - Theory

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
CC1	**C++ Programming**	**Core - Theory**	4	-	-	-	**4**	25	75	**100**

COURSE OUTCOMES (COs)

	Upon completion of the course, student can
CO-1	read and understand the concepts of Object-Oriented programming (OOP).
CO-2	apply the OOP concepts using C++ programming language.
CO-3	analyse the C++ programs and to infer the OOP concepts
CO-4	evaluate the performance of C++ programs and to modify the programs.

UNIT	Course Contents	No. of Hours
I	**Principles of OOP:** Basic concepts of Object-Oriented Programming – Benefits and applications – Object Oriented Languages – A Simple C++ Program - Structure of C++ program. **Basic Elements of C++:** Token – Keywords – Identifiers and constants – Basic Data Types – User-defined Data Types – Enumerated Data Type – Storage Class – Derived Data Types – Symbolic Constants – Declaration 0f Variables – Reference Variables – Scope Resolution Operator – Memory Dereferencing Operator – Memory Management Operators – Manipulators – Type Case Operator – Expressions – Operator Precedence – Control Structures **Functions in C++:** The Main function – Function Prototyping – Call by Reference – inline functions – Default Arguments – Recursion – Function Overloading – Math Library Functions.	**12**
II	**Classes and Objects:** Class – Declaring Objects – Defining Member Function – Private Member Function – Memory Allocation for Objects – Static Data Member and Member Functions – Array of Objects – Object as Function Arguments – Friend functions – Returning Objects – Pointers to Members. **Constructor and Destructors:** Constructor – Parameterized Constructors – Multiple Constructors in a Class – Dynamic Initialization of Objects – Copy Constructor – Constructing 2-Dimentional Arrays – Destructors.	**12**
III	**Operator Overloading:** Overloading unary, binary operators – Overloading Binary Operators using Friend – Rules – Type conversions. **Inheritance:** Types of Inheritance – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Ambiguity Resolution in Inheritance – Hierarchal Inheritance – Hybrid Inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes.	**12**
IV	**Pointers:** Declaration and Initializing Pointers – Manipulation of Pointers – Pointer Expression and Pointer Arithmetic – Using Pointers with Arrays and Strings – Pointers to Functions – Pointer to Objects – this Pointer – Polymorphism – Pointers to derived Classes – Virtual Functions – Pure Virtual Functions. **Managing Console I/O Operations:** C++ Streams – Unformatted I/O Operations – Formatted Console I/O Operations – Managing Output with Manipulators.	**12**

V	**Files:** Introduction – File stream classes – Opening and Closing a File – Detecting End-of-File – File Modes – File Pointers and their manipulations – Sequential Input and Output Operations – Updating a File: Random Access – Error Handling during File Operations – Command Line Arguments **Templates:** Class Templates – Class Templates with Multiple Parameters – Function Templates – Member Function Templates	**12**
	TOTAL HOURS	**60**
Textbooks		
1.	E. Balagurusamy, "Object-Oriented Programming with C++", 8th Edition, McGraw Hill, 2020	
Reference Books		
1.	Bjarne Stroustrup, "The C++ Programming Language", 4th Edition, Pearson Education, 2022	
2.	Reema Thareja, "Object Oriented Programming with C++", 2nd Edition, Oxford University Press, 2025	
3.	Herbert Schildt, "The Complete Reference C++" 4th Edition, McGraw Hill Education, 2017	

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

First Year – Semester I

CORE - Practical

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
CC2	**C++ Programming Laboratory**	**Core - Practical**	-	-	4	-	**3**	50	50	**100**

COURSE OUTCOMES (COs)	
	Upon completion of the course, student can
CO-1	read and understand the concepts of Object-Oriented programming (OOP).
CO-2	apply the OOP concepts using C++ programming language.
CO-3	analyse the C++ programs and to infer the OOP concepts
CO-4	evaluate the performance of C++ programs and to modify the programs.

No.	List of Exercises	No. of Hours
1.	Write a C++ program to demonstrate Class and Objects. Create a class Person with data members: name, date of birth, etc. Write a member function to read the relevant data. Write another function to calculate the age. Create 2 objects and show the elder one	
2.	Write a C++ program to demonstrate function overloading. Find the area of equilateral triangle (3 equals sides and 3 equal internal angles), isosceles triangle (2 sides are of equal length, and 1 side is different) and scalene triangle (all 3 sides are of different lengths and all 3 interior angles are unequal).	
3.	Write a C++ program to demonstrate the concept of Passing Objects to Functions. Create a class Time with data members hour, minute and second. Write a member function to add two given times in the hour, minute and second format. Pass two time objects to the sum member function.	
4.	Write a C++ program to demonstrate the Friend Functions. Create 2 classes. Write friend functions to add, multiply and compare the values in 2 classes. Add a menu in the main program to select the above operations	
5.	Write a C++ program to demonstrate Constructor and Destructor. Create class Employee with basic details including address for communication. Use new operator to allocate memory to store the employee's address and delete operator to free the allocated memory	
6.	Write a C++ program to change the sign of values in a 3 x 3 matrix and to find its transpose. Use unary – operator to change the sign and unary ~ operator to do the transpose. Write a C++ program to demonstrate Unary Operator Overloading	
7.	Write a C++ program to demonstrate Binary Operator Overloading to add 2 complex numbers. If A and B are complex objects, find A + B, 5 + A and A + 5	
8.	Write a C++ program to demonstrate: Single Inheritance	
9.	Write a C++ program to demonstrate: Multiple Inheritance	
10.	Write a C++ program to demonstrate Virtual Functions.	
11.	Write a C++ program to find the biggest, smallest and average of N Number passed through Command Line Arguments	

12.	Write a C++ program to find the roots of the quadratic equation. Demonstrate Error Handling features.	
13.	Write a C++ program to create an array of 5 fruits and display the name in alphabetical order using pointers	
14	Write a C++ program to create a text file. Prepare a simple resume in that file and close the file. Reopen the file in the read mode to display your resume.	
15.	Write a C++ program to open a binary random file and create N number of records. Display the contents of the record when the user specifies the record number.	
	TOTAL HOURS	**60**

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

First Year – Semester I
ELECTIVE - Theory

Subject Code	Subject Name	Category	L	T	P	S	Credit	Int	Ext	Tot
EC 1(a)	Discrete Mathematics	Elective - Theory	4	-	-	-	4	25	75	100

COURSE OUTCOMES (COs)	
	Upon completion of the course, student can
CO-1	understand how to solve problems based on discrete mathematics
CO-2	apply direct methods for solving linear systems
CO-3	select suitable methods to solve a problem
CO-4	write their own programs to solve problems using known programming languages.

UNIT	Course Contents	No. of Hours
I	**Set Theory**- Sets and elements-Specifications of sets-Identity and Cardinality - Set Inclusion - Equality of sets- proper sets - Power sets - Universal set -Operations on sets - ordered pairs - Cartesian product of sets	**12**
II	**Relations and Functions**- Definition – example - Relations on sets - Equivalence Relations - Equivalence Class - Functions	**12**
III	**Mathematical Logic-** Introduction – Statement (Propositions) – Laws of Formal Logic – Basic Set of Logical operators/operations - Propositions and Truth Tables – Algebra Propositions - Tautologies and Contradictions – Logical Equivalence – Logical Implication – Normal Forms	**12**
IV	**Matrix Algebra –** Introduction – Definition of a Matrix - Types of Matrices – Operations on Matrices – Related Matrices – Transpose of a Matrix – Symmetric and Skew - symmetric Matrices – Complex Matrix – Conjugate of a Matrix – Determinant of a Matrix – Typical Square Matrices.	**12**
V	**Adjoint and Inverse of a Matrix** – Singular and Non-singular Matrices – Adjoint of a Square Matrix – Properties of Adjoint to a Matrix – Properties of Inverse of a Matrix.	**12**
TOTAL HOURS		**60**

Textbooks	
1.	Discrete Mathematics, Swapan Kumar, Chakraborty and Bikash Kanti Sarkar, OXFORD University Press.

Reference Books	
1.	Discrete Mathematics, Third Edition, Seymour Lipschutz and Marc Lars Lipson, Tata McGraw Hill Education Private Limited.
2.	Discrete Mathematical Structures with Applications to Computer Science, by J. P. Tremblay, R. Manohar, TMH Edition.

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	3	1	3	2
CO 4	3	3	3	3	1	3	2
Total Score	12	12	12	12	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	3	1	3	2
CO 4	3	3	3	3	1	3	2
Total Score	12	12	12	12	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

First Year – Semester I
ELECTIVE - Theory

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
EC1(b)	**Operations Research**	**Elective - Theory**	4	-	-	-	**4**	25	75	**100**

COURSE OUTCOMES (COs)	
	Upon completion of the course, student can
CO-1	Formulate and solve Linear Programming Problems.
CO-2	Analyze the usage of Sequencing Problems.
CO-3	Evaluate Queueing Models.
CO-4	Apply PERT and CPM techniques to find the optimal solution.

UNIT	**Course Contents**	**No. of Hours**
I	The Nature and Meaning of OR– Applications of OR – Scope of OR. Linear Programming Problem: Formulation of LP problems – Graphical solution of LP problems – General formulation of LPP – Slack and Surplus variables – Standard form of LPP – Simplex Method I.	**12**
II	Assignment Problem: Mathematical formulation–Hungarian method–Unbalanced assignment problem	**12**
III	TRANSPORTATION PROBLEMS: Mathematical formulation –Methods for finding Initial Basic Feasible solution and Optimal solution – Degeneracy in Transportation Problems	**12**
IV	Queuing Models: Queuing System – Transient and Steady States– Kendal's Notation for representing Queuing Models – Various Models in Queuing System – Birth and Death Model. Problems only in M/M/1/ ∞ : FCFS	**12**
V	PERT and CPM Techniques: Basic Steps – Rules for drawing Network Diagram – Labeling Fulkerson's I–J Rule – Time Estimates and Critical Path in Network Analysis – Examples on optimum duration and minimum duration cost – PERT.	**12**
	TOTAL HOURS	**60**

Textbooks	
1.	S.D.Sharma, "Operations Research", Tenth Edition,Pearson,2017.

Reference Books	
1.	Hamdy A Taha,"Operations Research", Ninth Edition,2016.
2.	V.Sundaresan, K.S.Ganapathy Subramanian, K.Ganesan, "Resource Management Techniques", Ninth Edition, A. R.Publications, 2015.

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	2	2	3	3	2
CO 2	3	2	2	2	2	3	2
CO 3	3	2	2	2	2	3	2
CO 4	3	2	2	2	2	3	2
Total Score	12	8	8	8	9	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	2	2	3	3	2
CO 2	3	2	2	2	2	3	2
CO 3	3	2	2	2	2	3	2
CO 4	3	2	2	2	2	3	2
Total Score	12	8	8	8	9	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

First Year – Semester I
SKILL ENHANCEMENT - Practical

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
SEC1	**Office Automation Laboratory**	**Skill - Practical**	-	-	3	-	**3**	50	50	**100**

COURSE OUTCOMES (COs)

	Upon completion of the course, student can
CO-1	gain knowledge about document files, spreadsheets, presentations and databases.
CO-2	process data using formulas and functions
CO-3	Analyse data using charts and graphs in spreadsheets
CO-4	create and design presentations, create databases and design tables.

No.	List of Exercises	No. of Hours
1	Prepare your job resume in a detailed neat document. Highlight your strengths and important points. Use proper page setting features to improve the readability. Use Numbering, Bullets and Tables when required	
2	Prepare a month calendar in a document (Refer Microsoft Outlook Templates). Mark the public holiday and specify the reason below the calendar.	
3	Prepare a write-up about your college. Highlight the activities and facilities in various departments. Use Spell Check, Find and Replace, indent, header and footer, and page numbers.	
4	Prepare a document to show the alphabet picture chart. Show all 26 alphabets in a table with relevant pictures	
5	Prepare a semester-wise mark statement for a computer science class of 25 students using any spreadsheet. Display the total and average for each student and rank them based on the student's total mark. Give proper headings. Display the column headings in bold and italics	
6	Prepare a spreadsheet with 2 columns: name and one-line address [door_number, street_name] (20 rows). Use the following functions with various arguments **Text Function:** upper, lower, proper, trim, left, right, mid, clean, text, value, replace, substitute, find and concat Display the results in the next 14 columns.	
7	Prepare a spreadsheet with necessary input data columns: date, time, day, hour, etc (20 rows). Use the following functions with various arguments **Date Function:** date, today, now, datevalue, day, month, year, eomonth, weekday, datedif and workday **Time Function:** hour, minute, second, time and timevalue Display the results in the subsequent columns	
8	Prepare a spreadsheet with necessary input data columns (20 rows). Use the following functions with various arguments **Math Function:** abs, floor, ceiling, round, even, sign, mod, log, product, rand, sin, cos, tan, sum and base Display the results in the subsequent columns	

9	Prepare a spreadsheet with input data columns (20 rows). Use the following functions with various arguments **Statistical Function:** min, max, average, median, mode, stdev, var, count, countif, counta, rank and percentile Display the results in the subsequent columns	
10	Use any spreadsheet to plot a chart for marks obtained by the students – marks (Max: 5) vs frequency (Total students in class: 50).	
11	Prepare a presentation to display the sport day celebration in your campus	
12	Prepare a presentation to display a simple story with script dialogues and use simple animation.	
13.	Create a student database and specify validation rules for the fields: age, date of birth, pin code etc. Display your data with proper formatting.	
14	Create the employee database and populate data through an input form. Prepare a report containing the list of employees with designation and department.	
15.	Create a mobile shop database and use queries to display (i) products available in a specific brand (ii) products available within a price range. (iii) products with offers and discounts	
	TOTAL HOURS	**45**

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	3	1	3	2
CO 4	3	3	3	3	1	3	2
Total Score	12	12	12	12	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	3	1	3	2
CO 4	3	3	3	3	1	3	2
Total Score	12	12	12	12	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

First Year – Semester I
FOUNDATION COURSE - Theory

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
FC1	**Introduction to Computers, Artificial Intelligence & Machine Learning**	**FC - Theory**	3	-	-	-	**3**	25	75	**100**

COURSE OUTCOMES (COs)	
	Upon completion of the programme, the student can
CO-1	Gain knowledge on the fundamentals of computer and various problem-solving concepts
CO-2	Understand intelligent agents and problem-solving techniques.
CO-3	Learn knowledge representation and reasoning methods
CO-4	analyze ethical and societal impacts of AI & ML

UNIT	**Course Contents**	**No. of Hours**
I	Introduction: Characteristics of Computers - Basic Computer Organization - Computer Software: Types of Software - Machine Language - Assembly Language - High Level Language - Object Oriented Languages	**9**
II	Problem Solving concepts for the computer: Constant Variables - Data Types - Functions -Operators - Expressions and Equations - Organizing the Solution: Analyzing the problem - Algorithm - Flowchart - Pseudo code	**9**
III	Introduction to AI: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First Search– Heuristic search techniques: Generate and Test – Types of Hill Climbing.	**9**
IV	Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning	**9**
V	Introduction Machine Learning - Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression	**9**
	TOTAL HOURS	**45**

Textbooks

1. Maureen Sprankle and Jim Hubbard, (2009) - Problem Solving and Programming Concept, Ninth Edition, Prentice Hall.
2. Pradeep K.Sinha and Priti Sinha, (2004) - Computer Fundamentals‖, Sixth Edition, BPB Publications.
3. Joel Grus – Data Science from Scratch
4. Cathy O'Neil and Rachel Schutt – Doing Data Science
5. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig, Pearson Education.

	6. Artificial Intelligence, Elaine Rich – McGraw Hill. 7. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	2	1	3	2
CO 2	3	3	3	2	1	3	2
CO 3	2	2	2	2	1	3	2
CO 4	2	2	2	2	1	3	2
Total Score	10	10	19	8	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	2	1	3	2
CO 2	3	3	3	2	1	3	2
CO 3	2	2	2	2	1	3	2
CO 4	2	2	2	2	1	3	2
Total Score	10	10	19	8	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

First Year – Semester II

CORE - Theory

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
CC3	**Python Programming**	**Core - Theory**	4	-	-	-	**4**	25	75	**100**

COURSE OUTCOMES (COs)	
	Upon completion of the course, student can
CO-1	Write coding with python
CO-2	Work with Looping and jump statements
CO-3	Implement the concept of strings in various application
CO-4	Work with List, tuples and dictionary

UNIT	**Course Contents**	**No. of Hours**
I	Basics of Python Programming: History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. Python Arrays: Defining and Processing Arrays – Array methods.	**12**
II	Control Statements: Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. Jump Statements: break, continue and pass statements	**12**
III	Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. Python Strings: String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. Modules: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules	**12**
IV	Lists: Creating a list -Access values in List-Updating values in Lists-Nested lists - Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	**12**
V	Python File Handling: Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions-Renaming and deleting files.	**12**
TOTAL HOURS		**60**

Textbooks

1.	Reema Thareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.
2	Dr. R. Nageswara Rao, "Core Python Programming", First Edition, 2017, Dream tech Publishers.
Reference Books	
1.	VamsiKurama, "Python Programming: A Modern Approach", Pearson Education
2.	Mark Lutz, "Learning Python", Orielly.
3.	Adam Stewarts, "Python Programming",

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

First Year – Semester II

CORE - Practical

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
CC4	**Python Programming Laboratory**	**Core - Practical**	-	-	4	-	**3**	50	50	**100**

COURSE OUTCOMES (COs)	
	Upon completion of the course, student can
CO-1	Demonstrate the understanding of syntax and semantics of Python
CO-2	Identify suitable programming constructs for problem solving.
CO-3	Implement the concept of strings
CO-4	Analyze various concepts of PYTHON language to solve the problem in an efficient way

No.	**List of Exercises**	**No. of Hours**
1.	Program using Conditional Statements	
2.	Program using Jump Statements	
3.	Program using Recursion	
4.	Program using Strings	
5.	Program using Lists	
6.	Program using Tuples.	
7.	Program using Dictionaries	
8.	Program using Arrays	
9.	Program using Modules	
10.	Program for File Handling	
	TOTAL HOURS	**60**

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	2	1	3	2
CO 4	3	3	3	2	1	3	2
Total Score	12	12	12	10	4	12	8

0 – No Correlation 1 – Low 2 - Medium 3 – High

First Year – Semester II

ELECTIVE – Theory

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
EC2(a)	Digital Principles	Elective Theory	4	-	-	-	4	25	75	100

COURSE OUTCOMES (COs)	
	Upon completion of the course, student can
CO-1	understand the basics of number system and basic digital components.
CO-2	apply K-Maps to optimize the logical equations
CO-3	analyze and find minimal component circuits.
CO-4	design digital circuits for the given logical equations

UNIT	Course Contents	No. of Hours
I	Basic Gates: NOT, OR, AND – Universal Logic Gate NOR, NAND Number Systems and Codes: Binary Number System – Binary to Decimal Conversion – Decimal to Binary Conversion – Octal Numbers – Hexadecimal Numbers – The ASCII Code – The Excess-3 Code – The Gray Code.	12
II	Combinational Logic: Boolean Laws and Theorems – Sum of Products Method – Truth Table to Karnaugh Map – Pairs, Quads and Octets –Karnaugh Simplifications – Don't-Care Conditions – Product of Sums Method –Product of Sums Simplification.	12
III	Data Processing Circuits: Multiplexers – De-multiplexers – 1-of-16 Decoder – BCD-to-Decimal Decoder – Seven-Segment decoder – Encoders – Exclusive-OR gates – Parity Generators and Checkers. Binary Arithmetic: Binary Addition – Binary Subtraction – Unsigned Binary Numbers – Sign-Magnitude Numbers – 2's Complement Representation –2 's Complement Arithmetic	12
IV	Flip-Flops: RS Flip Flop — Edge Triggered RS Flip Flop – Edge Triggered D Flip Flop – Edge Triggered JK Flip Flops– JK Master Slave Flip Flop	12
V	Registers: Types of Registers – Serial_In-Serial_Out – Serial_In-Parallel_Out – Parallel_In-Serial_Out – Parallel_In-Parallel_Out – Universal Shift Register.	12
TOTAL HOURS		60

Textbooks

1. Donald P. Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", 7th Edition, Tata McGraw Hill, 2011

Reference Books

1. Anand Kumar A, "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited
2. Morris Mano M and Micheal D. Ciletti, "Digital Design", 8th Edition, Pearson Education

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	2	0	2	1
CO 2	3	3	3	2	0	2	1
CO 3	3	3	3	2	0	2	1
CO 4	3	3	3	2	0	2	1
Total Score	12	12	12	8	0	8	4

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	2	0	2	1
CO 2	3	3	3	2	0	2	1
CO 3	3	3	3	2	0	2	1
CO 4	3	3	3	2	0	2	1
Total Score	12	12	12	8	0	8	4

0 – No Correlation 1 – Low 2 - Medium 3 – High

First Year – Semester II
ELECTIVE - Theory

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
EC2(b)	**Pattern Recognition**	**Elective - Theory**	4	-	-	-	**4**	25	75	**100**

COURSE OUTCOMES (COs)		
	Upon completion of the programme, the student can	
CO-1	Gain knowledge on the fundamentals of Pattern Recognition techniques	
CO-2	Understand the linear discriminant functions and unsupervised learning and clustering	
CO-3	analyze the various Syntactical Pattern recognition techniques	
CO-4	Learn the Neural Pattern recognition techniques	
UNIT	**Course Contents**	**No. of Hours**
I	Pattern Recognition Overview: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches	**12**
II	Statistical Pattern Recognition: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.	**12**
III	Linear Discriminant Functions and Unsupervised Learning and Clustering: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification	**12**
IV	Syntactic Pattern Recognition: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition-Learning via grammatical inference.	**12**
V	Neural Pattern Recognition: Introduction to Neural Networks-Feedforward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR	**12**
	TOTAL HOURS	**60**

Textbooks	
1.	S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt. Ltd.

2	Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", 2nd Edition, Pearson Education in Asia.
3	S. Rajasekaran, G. A. Vijayalakshmi, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications", PHI.
Reference Books	
1.	**F. Martin, Mc neill, and Ellen Thro, "Fuzzy Logic: A Practical approach", AP Professional, 2000**
2.	**Timothy J Ross , Fuzzy Logic with Engineering Applications**

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	2	2
CO 2	3	3	3	3	1	2	2
CO 3	3	3	3	3	1	2	2
CO 4	3	3	3	3	1	2	2
Total Score	12	12	12	12	4	8	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	2	2
CO 2	3	3	3	3	1	2	2
CO 3	3	3	3	3	1	2	2
CO 4	3	3	3	3	1	2	2
Total Score	12	12	12	12	4	8	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

First Year – Semester II
SKILL ENHANCEMENT - Practical

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter -nal	Total
SEC2	**Data Structures Laboratory**	**Skill - Practical**	-	-	3	-	**2**	50	50	**100**

COURSE OUTCOMES (COs)

	Upon completion of the course, student can
CO-1	realize the concepts of stack and queue
CO-2	apply sorting techniques
CO-3	choose suitable search technique
CO-4	write their own programs using Python or C++

No.	List of Exercises	No. of Hours
1.	Perform stack operations	
2.	Perform queue operations	
3.	Perform binary tree traversal operations	
4.	Sort the given set of elements using Quick sort.	
5.	Search an element in an array using binary search	
6.	Sort the given set of elements using Insertion sort.	
7.	Create a Linked list and perform insertion and deletion	
8.	Perform BFS and DFS in a graph	
	TOTAL HOURS	**45**

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	3	1	3	2
CO 4	3	3	3	3	1	3	2
Total Score	12	12	12	12	4	12	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	1	3	2
CO 2	3	3	3	3	1	3	2
CO 3	3	3	3	3	1	3	2
CO 4	3	3	3	3	1	3	2
Total Score	12	12	12	12	4	12	8

0 – No Correlation **1 – Low** **2 - Medium** **3 – High**

First Year – Semester II
SKILL ENHANCEMENT - Theory

Subject Code	Subject Name	Category	Hours				Credits	Marks		
			L	T	P	S		CIA	Exter - nal	Total
SEC3	**Data Structures**	**Skill - Theory**	3	-	-	-	**2**	25	75	**100**

COURSE OUTCOMES (COs)	
CO-1	Understand the concepts of Linked List, Stack and Queue.
CO-2	Work with the Concepts of Trees and Graphs
CO-3	Apply searching and sorting techniques
CO-4	Analyze Backtracking

UNIT	**Course Contents**	**No. of Hours**
I	Arrays and ordered Lists Abstract data types – asymptotic notations – complexity analysis Linked lists: Singly linked list – doubly linked lists	**9**
II	Stacks – Queues – Circular Queues Trees – Binary Trees – Binary Tree Traversal – Binary Tree Representations – Binary Search Trees	**9**
III	Searching and Sorting: Sorting – Insertion Sort, Quick Sort, Merge Sort Searching – Linear search, Binary search	**9**
IV	Graphs - Representation of Graphs – Graph implementation – graph Traversals – BFS & DFS-Minimum Cost Spanning Trees	**9**
V	Backtracking – 8-Queen‟s problem - Graph Colouring Branch And Bound:– Travelling Sales Person Problem	**9**
	TOTAL HOURS	**45**

Textbooks

1. Seymour Lipshutz(2011),Schaum‟s Outlines - Data Structures with C, Tata McGraw Hill publications.
2. Ellis Horowitz and SartajSahni (2010), Fundamentals of Computer Algorithms, Galgotia Publications Pvt., Ltd.
3. Dr. K. Nagesware Rao, Dr. Shaik Akbar, ImmadiMurali Krishna, Problem Solving and Python Programming(2018)

Reference Books

1. Gregory L.Heileman(1996), Data Structures, Algorithms and Object-Oriented Programming, McGraw Hill International Edition, Singapore.

CO – PO Mapping (Course Articulation Matrix):

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	2	2	0	2	1
CO 2	3	3	2	2	0	2	1
CO 3	3	3	2	2	0	2	1
CO 4	3	3	2	2	0	2	1
Total Score	12	12	12	8	0	8	4

0 – No Correlation 1 – Low 2 - Medium 3 – High

CO – PSO Mapping (Course Articulation Matrix):

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	2	2	0	2	1
CO 2	3	3	2	2	0	2	1
CO 3	3	3	2	2	0	2	1
CO 4	3	3	2	2	0	2	1
Total Score	12	12	12	8	0	8	4

0 – No Correlation 1 – Low 2 - Medium 3 – High

Model Question Paper

C++ Programming

Duration: 3 hrs **Maximum marks: 75**

PART – A

Choose the Correct answer (10 x 1 = 10 marks)

Answer All Questions

1. What would be the output of the following C++ program. **(K3)**

```
void main()
{
  int a= -10;
  cout <<  ++a << " " << a--;
  }
```

a) -9 -9 b) -11 -10 c) -11 -11 d)-10 - 10

2. The process of making an operator to exhibit different behaviors in different instances is known as ..... . **(K1)**

a) operator overloading b) encapsulation
c) dynamic binding d) inheritance

3. if(1) is ..... . **(K2)**

a) always true b) always false c) either true or false d) neither true nor false

4. The if..else statement can be replaced by ..... operator. **(K1)**

a) bitwise b) conditional c) * d) &

5. A non member function that can access the private data of a class is known as ..... function **(K1)**

a) static b) member c) friend d) library

6. The destructor is executed when the object ..... **(K1)**

a) goes out of scope b) is not used c) contains nothing d) is created

7. Which of the following operator cannot be overloaded? **(K1)**

a) << b) >> c) ++ d) ?:

8. When is a class declared as virtual? **(K2)**

a) two or more classes involved in inheritance have common base class
b) to access base class members directly by the derived class
c) more than one class is derived
d) prevent a base class from inheritance

9. The file handling classes ifstream, ofstream and fstrream classes are derived from ..... class **(K1)**

a) fstreambase b)iofstream c) streambase d) iofstreambase

10. The file mode used for opening the file in append mode is ..... **(K1)**

a) ios::ate b) ios::out|ios::app c) ios::app d)ios::APP

PART – B (5 x 5 = 25 marks)

Answer All Questions choosing either (a) or (b)

11. a) Enumerate and explain the basic data types in C++. **(K2)**

(OR)

b) Expound the structure of C++ program **(K2)**

12. a) With examples show how static data members and static member functions are accessed in C++? **(K3)**

(OR)

b) Write a C++ program to determine the smallest of two numbers. **(K3)**

13. a) Demonstrate operator overloading with unary minus operator **(K3)**

(OR)

b) Explain single inheritance with example program. **(K2)**

14(a). Analyze the advantages and limitations of using 'this' pointer in different programming situations. **(K4)**

(OR)

14(b). Examine pointer declaration, initialization and usage with suitable examples. **(K4)**

15(a). Evaluate different file modes and justify the most suitable mode for given scenarios. **(K5)**

(OR)

15(b). Design a generic template solution for handling multiple data types. **(K6)**

PART C

Answer either (a) or (b) (5 × 8 = 40)

16(a). Explain how functions are declared, defined and called. **(K2)**

(OR)

16(b). Demonstrate function overloading with example program. **(K3)**

17(a). Explain constructors in C++. **(K2)**

(OR)

17(b). Write a C++ program to find the sum and average of N numbers. **(K3)**

18(a). Analyze multilevel inheritance and compare it with single inheritance. **(K4)**

(OR)

18(b). Design a derived class demonstrating constructor invocation order. **(K6)**

19(a). Analyze how pointers are used with arrays and strings **(K4)**

(OR)

19(b). Evaluate different output manipulators for formatting requirements. **(K5)**

20(a). Analyze opening/closing files and file stream classes in a real application. **(K4)**

(OR)

20(b). Analyze error handling during file operations. **(K4)**