

Shree Warana Vibhag Shikshan Mandal's

WARANA UNIVERSITY, WARANANAGAR

(A State Public University established under Section 3 (6) of MPUA,
2016)

॥ विद्या सर्वस्य भूषणम् ॥



Established: 2025

Structure & Syllabus For Bachelor of Science (B. Sc.) in Computer Science

UNDER

Faculty of Science & Technology

B. Sc. Part - II (Semester - III and IV)

(As Per National Education Policy – 2020) With Effect

from Academic Year 2026-27 Onwards

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Title of the Course: B.Sc. (Computer Science)

Preamble:

The B. Sc. (Computer Science) and B. Sc. (Computer Science) course is a systematically designed program with Computer Science as a major subject under the faculty of Science and Technology. The objective of the course is to prepare students to undertake careers involving problem solving using computer science and technologies, or to pursue advanced studies and research in computer science. The syllabus which comprises of Computer Science (Major) subject along with that of the three allied subjects (Computer Science)(Minor) covers the foundational aspects of computing sciences and also develops the requisite professional skills and problem solving abilities using computing sciences.

Introduction:

At the first year of under-graduation, the basic foundations of two important skills required for software development are laid. A course in problem solving and programming along with a course in database fundamentals forms the preliminary skill set for solving computational problems. The practical courses are designed to supplement the theoretical training in the year. Along with Computer Science (Major), VSC and SEC courses help in building a strong technical foundation. Another aspect of this course is IKS which tells about the rich heritage and advancement of India in the field of computation.

In the second year of under-graduation, computational problem solving skills are further strengthened by a course in Data structures, C++ and python programming. Software engineering concepts that are required for project design are also introduced. Essential concepts of computer networking are also introduced this year. The practical course included in both semesters complements the theory courses. Field projects/ OJT are introduced so that students can implement the concept they have learnt in first year.

In Second Year, the “Subject 1: Computer Science” will be the Major Subject and the Minor subject will be chosen from “Subject 2 or Subject 3”. Subject 2 and Subject 3 will not be available as Major Subjects in Second Year and Third Year

At the third year of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Theory courses are adequately supplemented by hands-on practical courses. Major elective courses are taking care of recent advancement in the field of computer science. Minor and Skill Enhancement courses enable the students to acquire additional skills.

At the fourth year (honors) and (research) of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Practical courses and field projects enable students to get hands-on training. Various learning tracks are open through Major elective courses. Research methodology course will create interest among the students to carry research in the field of computer science.

Objectives:

- To develop problem solving abilities using a computer.
- To build the necessary skill set and analytical abilities for developing computer based solutions for real life problems.
- To train students in professional skills related to the Software Industry.
- To prepare the necessary knowledge base for research and development in Computer Science.
- To help student's build-up a successful career in Computer Science and to produce entrepreneurs who can innovate and develop software products.

Eligibility

- a) H.S.C. (10 + 2) Science stream with Mathematics.
- b) Three years diploma course after S.S.C. (10th std.) of Board of Technical Education conducted by Government of Maharashtra or its equivalent.

Programme Out comes:

PO No.	Outcomes
PO1	Develop creative skills, critical thinking, analytical skills and research to address the real world problems using computational skills
PO2	Understand and apply mathematical foundation, computing and domain knowledge and develop computing models for defined problems
PO3	Understand software project management and computing principles with computing knowledge to manage projects in multidisciplinary environments
PO4	Illustrate the concepts of systems fundamentals, including architectures and organization, operating systems, networking and communication
PO5	Understand and apply the concepts of Digital Electronics, Computer Architecture, IoT etc.
PO6	Recognize the need for and develop the ability to engage in continuous learning as a Computing professional
PO7	Apply modern computing tools, skills and techniques necessary for innovative software solutions
PO8	Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations
PO9	Gain Self Discipline and commit Professional Ethics in global economic Environment
PO10	Individual & Team Work: Ability to work as a member or leader in diverse teams in multidisciplinary environment
PO11	Identify opportunities, entrepreneurship vision and use innovative ideas to create value and wealth for the betterment of the individual and society

Warana University,Warnangar

Structure of UG Program as per NEP-2020

Name of Program :- B.Sc. (Computer Science)**Major Course: - Computer Science****SCHEME OF TEACHING AND EXAMINATION:** [The scheme of teaching and examination should be given as applicable to the course/paper concerned.]**Level:- 5.0 (Second Year) Sem:-III**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	IE	UE	Total
Major Core	2502USCSMJ301	Web Technology with PHP Programming	2		2		10	40	50
	2502USCSMJ302	Data structure using C++	2		2		10	40	50
	2502USCSMJ303	Lab Course based on MJ-T1 & MJ-T2		2		4	10	40	50
VSC(2)(I) (Major Specific)	2502USCSVSC301 (P)	Angular JS		2		4	10	40	50
SEC(2)(I)	2502USCSSEC301	Software Engineering	2		2		10	40	50
Minor	2502USCSMN301	Introduction to Web Technology	2		2		10	40	50
	2502USCSMN302	Data Structure using OOP	2		2		10	40	50
	2502USCSMN303	Lab Course based on MN-T1 & MN-T2		2		4	10	40	50
OE(2)(I)	2502USCSOE301 (T)	Digital Marketing I	2		2		10	40	50
AEC(2)	2502USCSAEC301	From University Basket	2		2		10	40	50
CC(2)	CC-(I)(T)	From University Basket	2		2		10	40	50
Total			16	06	16	12			550

Level:- 5.0 (Second Year)Sem:-IV

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	IE	UE	Total
Major Core	2502USCSMJ401	A.I with Machine Learning	2		2		10	40	50
	2502USCSMJ402	Python Programming	2		2		10	40	50
	2502USCSMJ403	Lab Course based on MJ-T1 & MJ-T2		2		4	10	40	50
SEC(2)(II)	2502USCSSEC402	Computer Networking	2		2		10	40	50
Minor	2502USCSMN401	Introduction to A.I	2		2		10	40	50
	2502USCSMN402	Basics Of Python	2		2		10	40	50
	2502USCSMN403	Lab Course based on MJ-T1 & MJ-T2		2		4	10	40	50
OE(2)(II)	2502USCSOE402 (T)	Digital Marketing II	2		2		10	40	50
AEC(II)(2)	2502USCSAEC402 (T)	From University Basket	2		2		10	40	50
CEP(I)(2)	2502USCSCEP401	Field Project		2		4	10	40	50
VECI(2)	2502USCSVEC402 (T)	Environmental Studies	2		2		10	40	50
Total			16	06	16	12			550

MEME Instructions:

In alignment with the National Education Policy (NEP) 2020, the Bachelor of Science (B.Sc.) program adopts the Multiple Entry and Multiple Exit (ME-ME) framework. This flexible structure is designed to provide students with academic mobility, skill development, and lifelong learning opportunities. Through ME-ME framework, the program enables students to enter and exit at different stages with appropriate certifications. Information regarding different entry and exit options available to students and respective mandatory number of credits to be earned by the students are provided in the table below.

Year	Stage of exit	Type of Award	Mandatory Credits to be earned	Minimum credits to be earned
1	After successful completion of One Year	Undergraduate Certificate in Science	44	40
2	After successful completion of Two Year	Undergraduate Diploma in Science	88	80
3	After successful completion of Three Year	Bachelor of Science Degree	132	120

Re-entry provision:

Students leaving after a undergraduate certificate or undergraduate diploma may re-enter the program within 5 years by earning required credits through Academic Bank of Credits.

WaranaUniversity , Warananagar
S.Y.B.Sc. (Computer Science) - Sem – III
Course Type: Major (V)
Course Code:2502USCSMJ301
Course Title : WEB TECHNOLOGIES

Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Objectives:

- Giving the students the insights of the Internet programming and how to design and implement complete applications over the web.
- It covers the notions of Web servers and Web Application Servers, Design Methodologies with concentration on Object-Oriented concepts, Client-Side
- Programming, Server-Side Programming, Active Server Pages, Database Connectivity to web applications, Adding Dynamic content to web applications,
- Programming Common Gateway Interfaces, Programming the User Interface for the web applications.

Outcomes

- Analyze a web page and identify its elements and attributes. Create web pages using XHTML and Cascading Styles sheets.
- Installation and usage of Server software's
- Database Connectivity to web applications
- Build web applications using Apache Server and MySQL.

10 Hours

Module :I	
1.1Web Basics and Overview:	Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Tool box.
1.2HTML Common tags:	List, Tables, images, forms, frames, Basics of CSS and types of CSS.
1.3 Client-Side Programming (Java Script):	Introduction to Java Script, declaring variables, functions, Event handlers (onclick, onsubmit, etc.,) and Form Validation.

10 Hours

Module :II	
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2.1.1 Server-Side Programming (PHP):	Declaring Variables, Data types, Operators, Control structures, Functions, Reading data from web form controls like text buttons, radio buttons, list, etc., Handling File Uploads, Handling Sessions & Cookies.
2.1.2 Array	Concept, Types (Numerical/List, Associative/Maps, MultiDimensional), empty array, Initialisation of arrays ([operator, array() function, range() function), inserting element in array, Display entire array (print_r(), var_dump()), Sorting functions (sort(), rsort(), asort(), arsort(), ksort(), krsort(), natsort(), natcasesort(), array_multisort(), usort()), is_array() function, merge arrays (array_merge()) and using + operator, array as stack (array_push(), array_pop(), array_shift(), array_unshift()), reverse array (array_reverse()), array_keys() and array_value(), key().
2.2 Introduction to XML:	Document type definition, XML Schemas, Document Object model, Presenting XML, Introduction to XHTML, Using XML Processors: DOM and SAX.

10 Hours

Module :III	MySQL connectivity
3.1 Forms:	HTML forms, action and get & post methods. PHP super global variables (\$_PHP_SELF, \$_GET, \$_POST, \$_SERVER, \$_COOKIES, \$_REQUEST)
3.2 MySQL Database (Old or Improved):	Connect (mysql_connect()/mysqli_connect()), Close (mysql_close()/mysqli_close()), Select a database (mysql_select_db()/mysqli_select_db()), execute mysql query and create cursor (mysql_query()/mysqli_query()), Fetch rows from tables as row (mysql_fetch_row()/mysqli_fetch_row()) as numeric as well as associative array using cursor (mysql_fetch_array()/mysqli_fetch_array(), mysql_fetch_assoc()/mysqli_fetch_assoc()), release memory of cursor (mysql_free_result()/mysqli_free_result()).

Reference Books –

1. PHP and MySQL By Dreamtech Publications
2. PHP Concepts Unleashed For Novice – Vol I - By Poornima Naik, Kavita Oza, Evincepub Publishing
3. PHP A Beginner's Guide – Vikram Vaswami
4. PHP 5.1 for Beginners – By Ivan Bayross and Sharanam Shah (Shroff Publishers & Distributors)
5. Beginning PHP 6, Apache, MySQL Web Development- By Timothy Boronczyk, Elizabeth Narmore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass
6. PHP and MySQL by Rajendra Salokhe (Aruta Publications)
7. Learning PHP 7 by Antonio Lopez

8. Beginning PHP 5.3 by Matt Doyle
9. PHP-MySQL-Dummies-3rd-edition by Janet Valade
10. Computer Programming For Beginners: Learn The Basics Of HTML5-Joseph Connor
11. The Complete Reference HTML & CSS-Fifth Edition-Thomas A. Powell

WaranaUniversity , Warananagar
S.Y.B.Sc. (Computer Science) – SemIII
Course Type: Major (VI)
Course Code: 2502USCSMJ302
Course Title :Data Structure Using C++

Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Course Objectives

- To understand design and implementation, and manipulation of databases
- To apply theoretical concepts to real-world scenarios.
- Understand and Implement Searching Techniques
- Apply Sorting Algorithms for Data Organization
- Implement and Utilize Data Structure
- Develop Problem-Solving and Analytical Skills

Course Outcomes

On completion of this course, students will be able to:

- Apply Linear and Binary Search techniques to efficiently
- Analyze and implement sorting techniques
- Develop Singly and Doubly Linked Lists with operations such as insertion, deletion, searching, reversal, and concatenation.
- Evaluate the performance of Circular and Doubly Circular Linked Lists for dynamic memory-based data handling.
- To design and implement relational database systems, including creating tables, defining relationships, and implementing constraints.
- To understand Entity-Relationship (ER) diagrams to model database structures and convert them into relational models.

15Hours

Module :I	Introduction to Data structure & Linear Data Structures: Array, Stack and Queue
1.1 Concept of Abstract Data Types, Definitions:-	Data types, Data Object, Data structure (D-Data, A-Axioms, O-Operations), Classification (Primitive, Non-Primitive: Array, Files, List: Linear, Non-Linear), Basic Operations (Traversing, Searching, Insertion, Deletion, Sorting, Merging)

1.2 Definition Of Array 1.2.1 Applications of Array	Definition as a Data Structure, Types (one Dimensional, multi dimensional), Polynomial representation using array, Operations on Polynomial (Addition & Product)
1.3 Sorting:- 1.3.1 Sorting Techniques:-	Definition, Stable-Unstable Sorting, Adaptive-Non Adaptive Sorting, Order of Sorting (Increasing, Decreasing, Non Increasing, Non Decreasing) Bubble sort, Selection sort, Insertion sort, Quick sort.
1.4 Searching:	Linear and Binary Search
1.5 Stack: 1.5.1 Applications of stack	Definition, Operations (Push, Pop, Peek, Isfull, Isempty), Implementation using array. Recursion, Mathematical Expressions (Well-Parentheses, Notations: Infix, Prefix, Postfix, Conversion from Infix to Postfix and Infix to Prefix)
1.6 Queue	Definition of queue, Operations (Enqueue, Dequeue, Peek, Isfull, Isempty), Types of queue (Linear, Circular, Priority), Implementation Linear Queue using array (Compaction), Implementation Circular Queue using array (Use of Counter), Applications of Queue

15Hours

Module :II	Non Linear Data Structures: Linked List and Trees
2.1 Linked List 2.1.1 Application of linked list	Concept of linked list, Types of Linked List (Singly-Doubly, Linear-Circular), Implementation of Linked list, Operations on linear linked list (Insertion, Deletion, Display, Search) Implementation of stack and queue using linked list.
2.2 Trees:	Definition, Terminologies (Root, Child, Parent, Siblings, Descendant, Ancestor, Leaf/External node, Branch node/Internal node, Degree, Edge, Path, Level, Depth, Height of node, Height of tree, Forest)
2.3 Binary Tree:	Definition, Types (Full/Proper/Plane, Complete, Perfect, Skewed, Balanced), Array representation of Binary Tree
2.4 Binary Search Tree	Definition, Representation, Operations (Insertion, Deletion, Search, Tree Traversal: Preorder, Inorder, Postorder)

Reference Books

1. Data Structure using C and C++ -Rajesh Shukla
2. Data Structure using C and C++ - Tanenbaum
3. Data Structure using C++ - E Balagurusamy

4. Data Structure using C++ - Yashwant Kanetkar
5. Data Structure using C++ - D.S.Malik

❖ Practical Based on Major-V and VI

➤ Practical Based on -Major V

Take input either from keyboard, command line or using PHP form. And use either terminal or web page to demonstrate following examples,

Sr. No	Content
1	Linear Problem: i) Arithmetic Operations on 2 numbers(real) ii) Percentage of Student in 5 Subjects iii) Convert Degree Celsius To Degree Fahrenheit using $F = \frac{9}{5}C + 32$ iv) Calculate Simple Interest. v) Display type of given value.(gettype())
2	Decision Making - I: i) Check Integer is even or odd ii) Maximum Between 3 numbers iii) Leap Year or Not iv) Grade of a student from Percentage
3	Decision Making - II: Check whether given variable stores an integer, float, Boolean, null, array, string, resource.
4	Iterative - I: i) Factorial of natural number ii) Number of digits, sum of digits, reverse number and palindrome or not iii) Prime number (using break) iv) Permutation of 1,2,3(using continue) v) Patterns: Triangles, Pyramids
5	Iterative - II: i) Sequences: Natural Numbers, Odd Natural Numbers, Even Natural Numbers, Square Natural Numbers, Fibonacci Sequence ii) Series: Sum of First n natural numbers, sum of first n odd natural numbers, sum of first n even natural numbers, sum of first n reciprocals of factorial numbers
6	Array - I: Create an array and display array and Smallest, Largest, Sum, Average of integer numeric array
7	Array – II: i) Create two arrays and merge them. ii) Create array and reverse it. iii) Create associative array and fetch value array and key array from it.
8	Array – III: sort associative array using sort(), rsort(), asort(), arsort(), ksort(), krsort()

9	Array – IV: i) Create an array and treat it as stack from begin ii) Create an array and treat it as stack from end
10	String –I : i) Reverse string ii) String is Palindrome or not
	iii) Covert to Lower or Upper Case iv) Compare two strings
11	Function - I: i) Prime Function ii) Armstrong Function iii) Factorial Function(Recursive) iv) Swap Functions(Call By Reference)
12	Function - II: i) Input Variable number of integers to function and display their sum. ii) Demonstrate working of static variable and display number function call to given function
13	MySQL – I Initial: Connect to mysql database, create own database, choose database, create a table using PHP
14	MySQL – II Manipulation: To manipulate data in a table using PHP i) insert record in a table ii) update record in a table iii) delete record from a table
15	MySQL – III Selection: To display contents of table using PHP i) All records ii) First 10 records iii) Using criteria iv) Using order by particular column
16	MySQL – IV Grouping: To display sum, avg, count group by particular column using PHP
17	Case study 1: Creation of forms, small case study to create HTML pages using all the above learnt techniques. Case study 2: Creation of Forms layout designing by using div element with CSS property Case study 3: Create Multiple Web pages link them to publish a small website.

➤ Practical Based on-Major VI

Use “Problem Solving Techniques” For Following problems and implement code through C++ programming language. It include: Problem Analysis, Algorithm, Flowchart, Output Tracing using Algorithm, Source Code with Output.

Sr. No	Content
1	Polynomial: Create a class Poly having member dynamic array of doubles and an integer for degree to represent polynomial. Write appropriate member functions and operators to initialise, assign, display and do following i) Evaluate polynomial for given value ii) Add to polynomials iii) Multiply two polynomials
2	Stack And Application:(Using Array) i) Implementation and Operations on Stack ii) Check Expression is Well-Parenthesized or not “Use [, (, { brackets” iii) Conversion of infix expression to postfix and prefix “Use (only”
3	Queue:(Using Array) i) Implementation and Operations on Linear Queue ii) Implementation and Operations on Circular Queue(Use Count)
4	Sorting: i) Bubble sort ii) Insertion sort iii) Selection sort iv) Quick Sort(recursive function)
5	Searching: i) Linear Search ii) Binary Search
6	Linked List: i) Implementation and Operations on Linear Linked List ii) Implementation and Operations on Circular Linked List(Use Count) iii) Implementation and Operations on Circular Linked List
7	Binary Tree: Implementation and Operation of Binary Tree using array(use 0 to represent empty cell)
8	Stack ,Queue and Binary Search Tree using Linked List: i) Implementation and Operations using Linear Linked List on Stack ii) Implementation and Operations using Linear Linked List on Queue iii) Implementation and Operations using Circular Linked List on Circular Queue iv) Implementation and Operations (insert, display inorder preoder and post order with recursive function) using Linked List on BST.

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIII Course Type: Minor (V) Course Code: 2502USCSMN301 Course Title : Introduction to Web Technology		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Objectives:

- Giving the students the insights of the Internet programming and how to design and implement complete applications over the web.
- It covers the notions of Web servers and Web Application Servers, Design Methodologies with concentration on Object-Oriented concepts, Client-Side
- Programming, Server-Side Programming, Active Server Pages, Database Connectivity to web applications, Adding Dynamic content to web applications,
- Programming Common Gateway Interfaces, Programming the User Interface for the web applications.

Outcomes:-

- Analyze a web page and identify its elements and attributes. Create web pages using XHTML and Cascading Styles sheets.
- Installation and usage of Server software's
- Database Connectivity to web applications
- Build web applications using Apache Server and MySQL.

10 Hours

Module :I	
1.1Web Basics and Overview:	Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Tool box.
1.2HTML Common tags:	List, Tables, images, forms, frames, Basics of CSS and types of CSS.
1.3 Client-Side Programming (Java Script):	Introduction to Java Script, declaring variables, functions, Event handlers (onclick, onsubmit, etc.,) and Form Validation.

10 Hours

Module :II	
2.1.1 Server-Side Programming (PHP):	Declaring Variables, Data types, Operators, Control structures, Functions, Reading data from web form controls like text buttons, radio buttons, list, etc., Handling File Uploads, Handling Sessions & Cookies.
2.1.2 Array	Concept,Types(Numerical/List, Associative/Maps, MultiDimentional), empty array, Initialisation of arrays([] operator, array() function, range() function), inserting element in array, Display entire array(print_r(), var_dump()), Sorting functions(sort(), rsort(), asort(), arsort(), ksort(), krsort(), natsort(), natcasesort(), array_multisort(), usort()), is_array() function, merge arrays(array_merge()) and using + operator, array as stack(array_push(), array_pop(),array_shift(), array_unshift()), reverse array(array_reverse()), array_keys() and array_value(), key().
2.2Introduction to XML:	Document type definition, XML Schemas, Document Object model, Presenting XML , Introduction to XHTML, Using XML Processors: DOM and SAX.

10 Hours

Module :III	MySQL connectivity
3.1Forms:	HTML forms, action and get & post methods. PHP super global variables (\$_PHP_SELF, \$_GET, \$_POST, \$_SERVER, \$_COOKIES, \$_REQUEST)

3.2MySql Database(Old or Improved):	Connect(mysql_connect()/mysqli_connect()), Close(mysql_close()/mysqli_close()), Select a database(mysql_select_db()/mysqli_select_db()), execute mysql query and create cursor(mysql_query()/mysqli_query()), Fetch rows from tables as row(mysql_fetch_row()/ mysqli_fetch_row()) as numeric as well as associative arrayusing cursor(mysql_fetch_array()/mysqli_fetch_array()), mysql_fetch_assoc()/mysqli_fetch_assoc()),release memory of cursor(mysql_free_result()/ mysqli_free_result()).
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Reference Books –

1. PHP and MySQL By Dreamtech Publications
2. PHP Concepts Unleashed For Novice – Vol I - By Poornima Naik, Kavita Oza, Evincepub Publishing
3. PHP A Beginner's Guide – Vikram Vaswami
4. PHP 5.1 for Beginners – By Ivan Bayross and Sharanam Shah(Shroff Publishers &Distributors)
5. Beginning PHP 6, Apache, MySQL Web Development- By Timothy Boronczyk, ElizabethNaramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass
6. PHP and MySQL by Rajendra Salokhe(Aruta Publications)
7. Learning PHP 7 by Antonio Lopez
8. Beginning PHP 5.3 by Matt Doyle
9. PHP-MySQL-Dummies-3rd-edition by Janet Valade
10. Computer Programming For Beginners:Learn The Basics OfHTML5-Joseph Connor
11. The Complete Reference HTML & CSS-Fifth Edition-Thomas A.Powell
12. Learning Web Design: A beginner's Guide to HTML, CSS, Javascript, and Web Graphics - Jennifer Robbins
- HTML5: The Missing Manual - Matthew MacDonald

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIII Course Type: Minor (VI) Course Code: 2502USCSMN302 Course Title Data Structure using OOP		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Course Objectives

- To understand design and implementation, and manipulation of databases
- To apply theoretical concepts to real-world scenarios.
- Understand and Implement Searching Techniques
- Apply Sorting Algorithms for Data Organization
- Implement and Utilize Data Structure
- Develop Problem-Solving and Analytical Skills

Course Outcomes

On completion of this course, students will be able to:

- Apply Linear and Binary Search techniques to efficiently
- Analyze and implement sorting techniques
- Develop Singly and Doubly Linked Lists with operations such as insertion, deletion, searching, reversal, and concatenation.
- Evaluate the performance of Circular and Doubly Circular Linked Lists for dynamic memory-based data handling.
- To design and implement relational database systems, including creating tables, defining relationships, and implementing constraints.
- To understand Entity-Relationship (ER) diagrams to model database structures and convert them into relational models.

15 Hours

Module :I	Introduction to Data structure & Linear Data Structures: Array, Stack and Queue
1.1 Concept of Abstract Data Types, Definitions:-	Data types, Data Object, Data structure (D-Data, A-Axioms, O-Operations), Classification (Primitive, Non-Primitive: Array, Files, List: Linear, Non-Linear), Basic Operations (Traversing, Searching, Insertion, Deletion, Sorting, Merging)
1.2 Definition Of Array 1.2.1 Applications of Array	Definition as a Data Structure, Types (one Dimensional, multi dimensional), Polynomial representation using array, Operations on Polynomial (Addition & Product)
1.3 Sorting:- 1.3.1 Sorting Techniques:-	Definition, Stable-Unstable Sorting, Adaptive-Non Adaptive Sorting, Order of Sorting (Increasing, Decreasing, Non Increasing, Non Decreasing) Bubble sort, Selection sort, Insertion sort, Quick sort
1.4 Searching:	Linear and Binary Search
1.5 Stack: 1.5.1 Applications of stack	Definition, Operations (Push, Pop, Peek, Isfull, Isempty), Implementation using array. Recursion, Mathematical Expressions (Well-Parentheses, Notations: Infix, Prefix, Postfix, Conversion from Infix to Postfix and Infix to Prefix)
1.6 Queue	Definition of queue, Operations (Enqueue, Dequeue, Peek, Isfull, Isempty), Types of queue (Linear, Circular, Priority), Implementation Linear Queue using array (Compaction), Implementation Circular Queue using array (Use of Counter), Applications of Queue

15Hours

Module :II	Non Linear Data Structures: Linked List and Trees
2.1 Linked List 2.1.1 Application of linked list	Concept of linked list, Types of Linked List (Singly-Doubly, Linear-Circular), Implementation of Linked list, Operations on linear linked list (Insertion, Deletion, Display, Search) Implementation of stack and queue using linked list.
2.2 Trees:	Definition, Terminologies (Root, Child, Parent, Siblings, Descendant, Ancestor, Leaf/External node, Branch)

	node/Internal node, Degree, Edge, Path, Level, Depth, Height of node, Height of tree, Forest)
2.3 Binary Tree:	Definition, Types (Full/Proper/Plane, Complete, Perfect, Skewed, Balanced), Array representation of Binary Tree
2.4 Binary Search Tree	Definition, Representation, Operations (Insertion, Deletion, Search, Tree Traversal: Preorder, Inorder, Postorder)

References Books

1. Data Structure using C and C++ -Rajesh Shukla
2. Data Structure using C and C++ - Tanenbaum
3. Data Structure using C++ - E Balagurusamy
4. Data Structure using C++ - Yashwant Kanetkar
5. Data Structure using C++ - D.S.Malik

Minor Practical Based On V and VI

Practical Based on Minor -V

Take input either from keyboard, command line or using PHP form. And use either terminal or web page to demonstrate following examples,

Sr. No	Content
1	Linear Problem: 1)Arithmetic Operations on 2 numbers(real) 2)Percentage of Student in 5 Subjects 3)Convert Degree Celsius To Degree Fahrenheit using $F = ^\circ C \pm 32$ 4)Calculate Simple Interest. 5)Display type of given value.(gettype())
2	Decision Making - I: 1)Check Integer is even or odd 2)Maximum Between 3 numbers 3)Leap Year or Not 4)Grade of a student from Percentage
3	Decision Making - II: Check whether given variable stores an integer, float, Boolean, null, array, string, resource.
4	Iterative - I: 1)Factorial of natural number 2)Number of digits, sum of digits, reverse number and palindrome or not 3)Prime number (using break) 4)Permutation of 1,2,3(using continue) 5)Patterns: Triangles, Pyramids
5	Iterative - II: 1)Sequences: Natural Numbers, Odd Natural Numbers, Even Natural Numbers, Square Natural Numbers, Fibonacci Sequence 2)Series: Sum of First n natural numbers, sum of first n odd natural numbers, sum of first n even natural numbers, sum of first n reciprocals of factorial numbers
6	Array - I: Create an array and display array and Smallest, Largest, Sum, Average of integer numeric array
7	Array – II: 1)Create two arrays and merge them. 2)Create array and reverse it. 3)Create associative array and fetch value array and key array from it.
8	Array – III: sort associative array using sort(), rsort(), asort(), arsort(), ksort(), krsort()

9	Array – IV: 1)Create an array and treat it as stack from begin 2)Create an array and treat it as stack from end
10	String –I : 1)Reverse string 2)String is Palindrome or not
	3)Covert to Lower or Upper Case 4)Compare two strings
11	Function - I: 1)Prime Function 2)Armstrong Function 3)Factorial Function(Recursive) 4)Swap Functions(Call By Reference)
12	Function - II: 1)Input Variable number of integers to function and display their sum. 2)Demonstrate working of static variable and display number function call to given function
13	MySQL – I Initial: Connect to mysql database, create own database, choose database, create a table using PHP
14	MySQL – II Manipulation: To manipulate data in a table using PHP 1)insert record in a table 2)update record in a table 3)delete record from a table
15	MySQL – III Selection: To display contents of table using PHP 1)All records 2)First 10 records 3)Using criteria 4)Using order by particular column
16	MySQL – IV Grouping: To display sum, avg, count group by particular column using PHP
17	Case study 1: Creation of forms, small case study to create HTML pages using all the above learnt techniques. Case study 2: Creation of Forms layout designing by using div element with CSS property Case study 3: Create Multiple Web pages link them to publish a small website.

Practical Based on Minor VI

Use “Problem Solving Techniques” For Following problems and implement code through C++ programming language. It include: Problem Analysis, Algorithm, Flowchart, Output Tracing using Algorithm, Source Code with Output.

Sr. No	Content
1	Polynomial: Create a class Poly having member dynamic array of doubles and an integer for degree to represent polynomial. Write appropriate member functions and operators to initialise, assign, display and do following iv) Evaluate polynomial for given value v) Add to polynomials vi) Multiply two polynomials
2	Stack And Application:(Using Array) iv) Implementation and Operations on Stack v) Check Expression is Well-Parenthesized or not “Use [, (, { brackets” vi) Conversion of infix expression to postfix and prefix “Use (only”
3	Queue:(Using Array) iii) Implementation and Operations on Linear Queue iv) Implementation and Operations on Circular Queue(Use Count)
4	Sorting: ii) Bubble sort ii) Insertion sort iii) Selection sort iv) Quick Sort(recursive function)
5	Searching: iii) Linear Search iv) Binary Search
6	Linked List: iv) Implementation and Operations on Linear Linked List v) Implementation and Operations on Circular Linked List(Use Count) vi) Implementation and Operations on Circular Linked List
7	Binary Tree: Implementation and Operation of Binary Tree using array(use 0 to represent empty cell)
8	Stack ,Queue and Binary Search Tree using Linked List: v) Implementation and Operations using Linear Linked List on Stack vi) Implementation and Operations using Linear Linked List on Queue vii) Implementation and Operations using Circular Linked List on Circular Queue viii) Implementation and Operations (insert, display inorder preoder and post order with recursive function) using Linked List on BST.

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIII Course Type: VSC(Major Specific) Course Code: 2502USCSVSC301 Course Title: Angular JS		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	4	IE: 10 marks UE: 40 marks

Course Outcomes:-

After successful completion of this course,students will able to:

- Understand fundamentals of Angular JS and its application.
- Create routing solutions.
- Apply filter in Angular JS application.
- Explore Angular JS component.

List of Practical:-

Sr.No	Assignment Names
1	Downloading and Installing Angular -Js.
2	Create Student app with Angular Js ApplicationStructure and Organization.
3	Create Index.html and Create Directives,Ng-App and Angular Expressions.
4	Practical on Ng-Model and Ng-Bind Directives
5	Practical on Ng-Init Directive.
6	Practical on MVC(Model View Controller)
7	Practical on Data-Binding and its types.
8	Practical on Events,Event Handling Click Events.
9	Practical onMouse,Keyboard and Copy Paste Events
10	Practical onNg-Change Directive
11	Practical onNg-Repeat Directive
12	Practical onDate,Order-By Filter
13	Practical onNg-Show And Ng-hide Directives
14	Practical onNg-Include Directive
15	Displaying ValidationErrors,Custom Validation
16	Practical onServices using Angular-Js
17	Practical onInterval and Timeout Services
18	Practical onWindow Service
19	Practical on Routing Creating Single Page Application using Angular-Js
20	Practical on Scope and Its Types

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIII Course Type: SEC (T) Course Code: 2502USCSSEC301 Course Title: Software Engineering		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Course Objectives

1. To get knowledge and understanding of software engineering discipline.
2. To learn analysis and design principles for software project development.
3. Implement Agile Development Methodologies in real life Software Projects.

Course Outcomes

On completion of the course, student will be able to-

- 1: Identify data requirements, analyze and prepare data models.
- 2: Understand basic software engineering concepts and Process models.
- 3: Compare and chose a process model for a software project development.
- 4: Design different UML Diagrams..

Course Content:-

Module1	Introduction to Software Engineering	5 Hours
1.1 Definition of Software 1.2 Nature of Software Engineering 1.3 Changing nature of software 1.4 Mc Call's Quality factors 1.5 Software Process 1.6 The Process Framework 1.7 Umbrella Activities 1.8 Process Adaptation		

Module 2	Software Development Life Cycle	5 Hours
Introduction, Activities of SDLC 2.1 Preliminary Investigation and its activities. 2.2 Requirements engineering tasks (Inception, Elicitation, Elaboration, Negotiation, Specification, Validation, Requirements Management) 2.3 Fact finding techniques (Interview, Questionnaire, Record Review, Observation) 2.4 Determination of system requirements 2.5 Design of a system 2.6 Development of software 2.7 System testing (Unit Testing, Integration Testing, System Testing, Acceptance Testing) 2.8 System Implementation and Evaluation 2.9 System maintenance		
Module 3	Process Models	7 Hours
3.1 Generic Process Model 3.2 Prescriptive Process Models 3.2.1. The Waterfall Model 3.2.2 V-model 3.3 Incremental and Iterative Process Models 3.4 Evolutionary Process Models- Prototyping, Spiral Model 3.5 Rapid Application Development(RAD) 3.6 Concurrent Models 3.7 The Unified Process		
Module 4	Requirements Modeling-UML	13Hours

- 4.1 Introduction to UML
- 4.2 Structural Modeling
 - 4.2.1 Class Model
 - 4.2.2 Object Model
 - 4.2.3 Deployment Model
 - 4.2.4 Component Model
- 4.3 Behavioral Modeling
 - 4.3.1 Use case model
 - 4.3.2 Activity model
 - 4.3.3 State Chart Model
 - 4.3.4 Sequence model
- 4.4 Interaction Model-
 - 4.4.1 Sequence Model
 - 4.4.2 Collaboration Model

Reference Books:

1. Software Engineering: A Practitioner's Approach - Roger S. Pressman, McGraw hill (Eighth Edition) ISBN-13: 978-0-07-802212-8, ISBN-10: 0-07-802212-6
2. A Concise Introduction to Software Engineering - Pankaj Jalote, Springer ISBN: 978-1-84800-301-9
3. The Unified Modeling Language Reference Manual - James Rumbaugh, Ivar Jacobson, 3 Grady Booch ISBN 0-201-30998-X

Warana University ,Waranangar S.Y.B.Sc. (Computer Science) - Sem –III Course Type: OE. Course Code: 2502USCSOE301 Course Title: Digital Marketing I		
Teaching Scheme 02 Hours /Week	No. of Credits 2	Examination Scheme IE :10 Marks UE:40Marks
Course Objectives • To understand Digital Marketing as the most powerful marketing tool. • Learn to create digital marketing artworks. • Learn how to use email campaigns, blogging to produce worthwhile, pertinent material that draws in and engages a target audience.		
Course Outcomes On completion of the course, student will be able to— 1: Learn and visualize power to explore new ideas. 2: Analyze and develop their Marketing skills. 3: Analyze and understand tacts with corporate objectives and produce quantifiable outcomes from e-payment mechanisms. 4: Identify and apply target demographics and company objectives, increasing brand awareness and boosting conversions.		
Course Contents		
Chapter1	History of Digital Marketing	8 Hours
1.1. Introduction 1.2. Offline digital marketing - Electronic billboards, Radio marketing, T.V. marketing, Phone marketing 1.3. Online marketing - Search Engine Optimization (SEO), Social media marketing, E-mail marketing 1.4. Difference between conventional marketing and online marketing.		
Chapter2	Internet Marketing	8 Hours
2.1. Structure of Website – Team 2.2. Types of website - Static Website, Dynamic website, Personal, Commercial, Governmental, Non-profit organization 2.3. Web Portals - Type of Portals		

Chapter3	Classification of e-Commerce	8 Hours
3.1. Business to Business (B2B) Model 3.2. Business to Consumer(B2C) Model 3.3. Consumer to Consumer(C2C) Model 3.4. Consumer to Business (B2B) Model		
Case Study		6 Hours
Case Study 1: Digital Platform like subscription-based streaming service that offers a vast library of TV shows, movies, documentaries, and original content. (eg. Prime Video, Netflix etc) Case Study 2: Any Private sector bank in India–Digital Transformation and Customer Engagement, Retail banking, corporate banking, credit cards, loans, digital banking, etc. Case Study 3: Multispecialty Hospital in 2- Tier city -Cardiology and Orthopedic Departments Case Study 4: Content Marketing - like HupSpots Content Marketing creates valuable content like blog posts, e-books and infographics that address their target audience and establishing themselves as though leaders and attracting potential customers. Case Study 5: Any Newspaper like The New York Times – Digital Subscription Growth- Transition from print to digital revenue through subscriptions		
Reference Books:		
1 SEO 2025: Learn Search Engine Optimization with Smart Internet Marketing Strategies" by Adam Clarke 2 Digital Marketing: Nitin Kamat, Chinmay Kamat (Himalaya Publishing House)"Made to Stick: Why Some Ideas Survive and Others Die" by Chip Heath and Dan Heath 3 "Digital Marketing: Strategy, Implementation, and Practice" by Dave Chaffey and Fiona Ellis-Chadwick		

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIII Course Type: AEC(I)(T) Course Code: 2502USCSAEC301 Course Title: English		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE: 10 marks UE: 40 marks

AS Per University Syllabus

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIII Course Type: CC (T) Course Code: Course Title:		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE: 10 marks UE: 40 marks

As Per University Basket

WaranaUniversity , Warananagar S.Y.B.Sc. (Computer Science)SemIV Course Type: Major VII Course Code: 2502USCSMJ401 Course Title: A.I with Machine Learning		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Course Objectives

- Understand the various characteristics of a problem solving agent
- Learn about the different strategies involved in problem solving
- Learn about solving problems with various constraints
- Apply A.I to various applications like expert systems etc.
- Understand the different models of learning

Course Outcomes

- Have basic knowledge representation, problem solving, and learning methods of artificial intelligence
 - Provide the apt agent strategy to solve a given problem
 - Represent a problem using first order and predicate logic
 - Design applications like expert systems and chat-bot
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem

10 Hours

Module -1	Introduction to Artificial Intelligence and Search Techniques ,Problem-Solving Agent:
1.1Problem-Solving Agent:	Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.
1.2 Search Techniques:	Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best -first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

10 Hours

Module -2	Constraint Satisfaction Problems and Game Theory, Knowledge & Reasoning
2.1 Problems and Game Theory	Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening
2.2 Knowledge & Reasoning	Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning

10 Hours

Module:-III	Introduction to Machine Learning:
3.1 Introduction to Machine Learning:	Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.

Text Books

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015.
2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998.

Reference Books

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd ed., 2017.
2. Patterson, "Introduction to Artificial Intelligence & Expert Systems", Pearson, 1st ed. 2015.
3. Saroj Kaushik, "Logic & Prolog Programming", New Age International, 1st edition, 2002.
4. Joseph C. Giarratano, Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2007.

WaranaUniversity , Warananagar S.Y.B.Sc. (Computer Science) Sem IV Course Type: Major VIII Course Code: 2502USCSMJ402 Course Title: Python Programming with OOP		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Course Objectives

- To learn and understand python programming basics and paradigm
- The concept of data abstraction and the problem of building implementations of abstract data types are emphasized
- To acquaint students with data structures used when programming for the storage and manipulation of data

Course Outcomes: After the completion of the course the student will be able to:

- Understand Object-Oriented Concepts
- Apply Object-Oriented Techniques in Python
- Demonstrate Inheritance and Polymorphism
- Implement Advanced OOP Features

10 Hours

Module:-1	Introduction to Object Oriented Programming:
1.1 Introduction to OOP	Programming Paradigms, What Is Object-Oriented Programming?, Features of OOP, Advantages and disadvantage of OOP, Function Overloading, Operator Overloading, Static and Dynamic Binding, Constructors and Destructors, Techniques of Object-Oriented Programming, When to use OOP?, Applications of OOP.
1.2 Introduction to Python Programming	History , Features , Working with Python, Installing Python, basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; Arithmetic and Logical operators and Boolean expressions. Debugging, comments in the program; understanding error messages; Catching exceptions using try and except.

10 Hours

Module:-2	Classes and Objects
2.1 Classes and Objects in python	Python Classes, Objects, Specifying attributes and behaviors, instance methods, instance attributes, static methods, constructor, types of constructors(default, parameterized), class methods as alternative constructor, constructor overloading, method overloading.
2.2 Data, Expressions, Statements:	Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution
2.3 Control Flow, Functions:	Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

10 Hours

Module-3	Inheritance and Polymorphism
	Inheritance in Python (Syntax, Advantages,), Access Modifiers in Python, Types of Inheritance (single, multiple, multilevel, hierarchical and hybrid), Polymorphism-Method Overriding, magic methods and Operator Overloading.

Reference Books:

1. Michael H Goldwasser & David Letscher: Object-Oriented Programming in Python 1st Edition, Prentice Hall, 2007.
2. Dusty Phillips: Python 3 Object Oriented Programming, PACKT Publishing, 2010
3. David Ascher, Alex Martelli: Python Cookbook, Oreilly

➤ Practical Lab:-Major VII and VIII

Course Objectives

- To acquire programming skills in core Python
- To acquire Object Oriented Skills in Python
- To design and implement various data structure algorithms
- To develop the skill of designing Graphical user Interfaces in Python
- To develop the ability to write database applications in Python

Course Outcomes

- Gain knowledge on the basic principles of Python programming language
- Demonstrate the use of built in data structures list and dictionary
- Implement object oriented concepts
- Implement database and GUI application
- Design and implement a program to solve a real world problem

LIST OF EXPERIMENTS

➤ Practical Lab on Major Paper VII

Sr.No	Experiments Names
1	Write a Program to implement BFS/DFS Traversal?
2	Write simple facts for the statements and quering it.
3	Write a program for family -tree
4	Write a program for monkey-banana problem
5	Write a program to implement Tic-Tac-Tac game.
6	Write programs for computation of recursive function like factorial Fibonacci numbers etc.
7	Write program to solve five queens problem.
8	Write a program for water jug problem.
9	Write a program for travering salesman problem.
10	Write a program to implement all set operations.

➤ Practical Lab On Major Paper VIII

Sr.No	Experiments Names
1	Program to demonstrate simple class and instance of a class.
2	Program to demonstrate use of class methods.
3	Program to demonstrate default constructor.
4	Program to demonstrate parameterized constructor.
5	Program to demonstrate constructor overloading
6	Program to demonstrate destructor.
7	Program to demonstrate visibility modes.
8	Program to implement single inheritance.

9	Program to implement multiple inheritance.
10	Program to implement multilevel inheritance
11	Program to implement hybrid inheritance.
12	Program to demonstrate method overriding
13	Program to demonstrate operator overloading using magic method
14	Python program for finding GCD of two numbers.
15	Square root of a number by Newton's Method.
16	Find Exponentiation of a number.
17	Maximum from a list of numbers.
18	Write a program to find First N prime numbers.
19	Program on control flow and conditional statements.
20	Program on Array with python

WaranaUniversity , Warananagar S.Y.B.Sc. (Computer Science)SemIV Course Type: Minor VII Course Code: 2502USCSMN401 Course Title: Introduction to A.I		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Course Objectives

- Understand the various characteristics of a problem solving agent
- Learn about the different strategies involved in problem solving
- Learn about solving problems with various constraints
- Apply A.I to various applications like expert systems etc.
- Understand the different models of learning

Course Outcomes

- Have basic knowledge representation, problem solving, and learning methods of artificial intelligence
 - Provide the apt agent strategy to solve a given problem
 - Represent a problem using first order and predicate logic
 - Design applications like expert systems and chat-bot
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem

10 Hours

Module -1	Introduction to Artificial Intelligence and Search Techniques ,Problem-Solving Agent:
1.1Problem-Solving Agent:	Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.
1.2 Search Techniques:	Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best -first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

10 Hours

Module -2	Constraint Satisfaction Problems and Game Theory, Knowledge & Reasoning
2.1 Problems and Game Theory	Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening
2.2 Knowledge & Reasoning	Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning

10 Hours

Module:-III	Introduction to Machine Learning:
3.1 Introduction to Machine Learning:	Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.

Text Books

2. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015.
2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998.

Reference Books

5. Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd ed., 2017.
6. Patterson, "Introduction to Artificial Intelligence & Expert Systems", Pearson, 1st ed. 2015.
7. Saroj Kaushik, "Logic & Prolog Programming", New Age International, 1st edition, 2002.
8. Joseph C. Giarratano, Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2007

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIV Course Type: Minor VIII Course Code: 2502USCSMN402 Course Title- Basics Of Python		
Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE: 10 marks UE: 40 marks

Course Objectives

- To learn and understand python programming basics and paradigm
- The concept of data abstraction and the problem of building implementations of abstract data types are emphasized
- To acquaint students with data structures used when programming for the storage and manipulation of data

Course Outcomes: After the completion of the course the student will be able to:

- Understand Object-Oriented Concepts
- Apply Object-Oriented Techniques in Python
- Demonstrate Inheritance and Polymorphism
- Implement Advanced OOP Features

10 Hours

Module:-1	Introduction to Object Oriented Programming:
1.1 Introduction to OOP	Programming Paradigms, What Is Object-Oriented Programming?, Features of OOP, Advantages and disadvantage of OOP, Function Overloading, Operator Overloading, Static and Dynamic Binding, Constructors and Destructors, Techniques of Object-Oriented Programming, When to use OOP?, Applications of OOP.
1.2 Introduction to Python Programming	History , Features , Working with Python, Installing Python, basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; Arithmetic and Logical operators and Boolean expressions. Debugging, comments in the program; understanding error messages; Catching exceptions using try and except.

10 Hours

Module:-2	Classes and Objects
2.1 Classes and Objects in python	Python Classes, Objects, Specifying attributes and behaviors, instance methods, instance attributes, static methods, constructor, types of constructors(default, parameterized), class methods as alternative constructor, constructor overloading, method overloading.
2.2 Data, Expressions, Statements:	Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution
2.3 Control Flow, Functions:	Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

10 Hours

Module-3	Inheritance and Polymorphism
	Inheritance in Python (Syntax, Advantages,), Access Modifiers in Python, Types of Inheritance (single, multiple, multilevel, hierarchical and hybrid), Polymorphism-Method Overriding, magic methods and Operator Overloading.

Reference Books:

4. Michael H Goldwasser & David Letscher: Object-Oriented Programming in Python 1st Edition, Prentice Hall, 2007.
5. Dusty Phillips: Python 3 Object Oriented Programming, PACKT Publishing, 2010
6. David Ascher, Alex Martelli: Python Cookbook, Oreilly

➤ Practical Lab:-Minor VII and VIII

Course Objectives

- To acquire programming skills in core Python
- To acquire Object Oriented Skills in Python
- To design and implement various data structure algorithms
- To develop the skill of designing Graphical user Interfaces in Python
- To develop the ability to write database applications in Python

Course Outcomes

- Gain knowledge on the basic principles of Python programming language
- Demonstrate the use of built in data structures list and dictionary
- Implement object oriented concepts
- Implement database and GUI application
- Design and implement a program to solve a real world problem

LIST OF EXPERIMENTS

➤ Practical Lab on Minor Paper VII

Sr.No	Experiments Names
1	Write a Program to implement BFS/DFS Traversal?
2	Write simple facts for the statements and quering it.
3	Write a program for family -tree
4	Write a program for monkey-banana problem
5	Write a program to implement Tic-Tac-Tac game.
6	Write programs for computation of recursive function like factorial Fibonacci numbers etc.
7	Write program to solve five queens problem.
8	Write a program for water jug problem.
9	Write a program for travering salesman problem.
10	Write a program to implement all set operations.

➤ Practical Lab On Minor Paper VIII

Sr.No	Experiments Names
1	Program to demonstrate simple class and instance of a class.
2	Program to demonstrate use of class methods.
3	Program to demonstrate default constructor.
4	Program to demonstrate parameterized constructor.
5	Program to demonstrate constructor overloading
6	Program to demonstrate destructor.
7	Program to demonstrate visibility modes.
8	Program to implement single inheritance.

9	Program to implement multiple inheritance.
10	Program to implement multilevel inheritance
11	Program to implement hybrid inheritance.
12	Program to demonstrate method overriding
13	Program to demonstrate operator overloading using magic method
14	Python program for finding GCD of two numbers.
15	Square root of a number by Newton's Method.
16	Find Exponentiation of a number.
17	Maximum from a list of numbers.
18	Write a program to find First N prime numbers.
19	Program on control flow and conditional statements.
20	Program on Array with python

Warana University, Warananagar S.Y.B.Sc. (Computer Science) - Sem – IV Course Type: SEC(T) Course Code: 2502USCSSEC402 Course Title : Computer Networks		
Teaching Scheme 2 Hours /Week	No. of Credits 2	Examination Scheme IE: 10 marks UE: 40 marks
Prerequisites • Understanding of computer hardware components. • Understanding of basic data communication terminology. • Knowledge of how data is transmitted over networks (packets, frames).		
Course Objectives • To learn basic concepts and terminology related to computer networks • To understand cyber security principles and techniques to secure networks. • To understand and analyze different network devices. • To equip students with the knowledge and skills necessary to design, implement, manage, and secure computer networks in various environments.		
Course Outcomes On completion of the course, student will be able to– 1: Understand the principles of wireless networking. 2: Configure wireless networks. 3: Demonstrate the ability to apply theoretical knowledge in practical lab settings. 4: Utilize troubleshooting techniques and tools to diagnose and resolve common network issues effectively. 5: Identify potential security threats to networks and apply appropriate security measures. 6: Apply security practices in real-world scenarios.		
Course Contents		
Module 1	Study of Network Devices , Cables and Configuration	10 Hours
• Introduction to Computer Network: Use of computer network: Access to information, person to person communication, electronic commerce, internet of things; • Types of computer network: Broadband access network, Mobile and wireless network, content delivery network, transit network, Enterprise network. • Network Technology: Personal Area Network, Local Area Network, Metropolitan Area Network, Wide Area Network, intern networks, example of network (Internet, Mobile network, wireless network-Wi-Fi); • Reference Model: OSI, TCP/IP, Critique of the OSI and TCP/IP reference models;		

- **Policy, Legal & Social Issues:** Online speech, net neutrality, security & privacy, disinformation. Keywords: IoT, Broadband, LAN, MAN, WAN, OSI, TCP/IP..

Module 2	Network Security and Information Security	10 Hours
• Fundamentals of network and information security: principles of security and attack. Security Goals (Confidentiality, Integrity, and Availability), Non-Repudiation. Overview of Security. • Threats and Vulnerability: Types of attacks on Confidentiality, Integrity and Availability. • Vulnerability and Threats: Phishing Attacks, E-mail threats, Web-threats, Intruders and Hackers, Insider threats, SQL injection Attacks, Ransomware. • Malware: Worms, Virus, Spams, Adware, Spyware, Trojans. • Security Technology: Firewalls, Intrusion detection and prevention systems, • Scanning and Analysis Tools: Biometric access controls, Cipher methods, Cryptographic algorithms, Cryptographic tools, Protocols for secure communication. • Keywords: phishing, SQL injection, Worms, Computer virus, Spyware, Trojans, Firewall, Cipher, Cryptography.		
Module 3	Computer and Cyber-crimes	10 Hours
• Computer and Cyber-crimes: Cyber-crimes and related concepts, distinction between cyber-crimes and conventional crimes, Cyber objectives. Kinds of cyber-crimes, cyber stalking, forgery and fraud; crime related to IPRs, cyber terrorism, Ransom ware attacks, computer vandalism. • Cyber Laws- Introduction to IT laws & Cyber Crimes:. Internet Hacking, Cracking, Viruses, Virus Attacks, Software Piracy Intellectual property, Legal System of Information Technology, Social Engineering, mail Bombs, Bug Exploits. • Scope of cyber laws: e-commerce, online contracts, IPRs (copyright, trademarks and software patenting) e-taxation e governance and cyber-crimes, Cyber law in Indian with special reference to Information Technology Act, 2000 and Recent amendments. • Keywords: cyber-crime, cyber stalking, cyber-fraud, IPR, IT laws, e- commerce, e-taxation, e-governance mail bombs.		

Textbooks:

- Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, Computer Networks, 6th Edition, (2021), Pearson
- Michael E Whitman and Herbert J Mattord, Principles of Information Security, Fourth Edition, CENGAGE Learning, 6 th Indian Reprint.
- M. Merkow, J . Breithaupt, Information Security Principles and Practices, 2 nd Edition, 2014, Pearson Education.

- G.R.F. Snyder, T Pardoe, Network Security, Cengage Learning.
- Praveen Kumar Shukla, Surya Prakash Tripathi, Ritendra Goel “Introduction to Information Security and Cyber Laws”, 2014, Dreamtech Press.
- Faiyaz Ahamad, KLSI “Cyber Law and Information Security”, 2013, Dreamtech Press.
- Books published by M.P. Hindi Granth Academy, Bhopal

Reference books:

- Kurose James F., Ross Keith W., Computer Networking, A Top-Down Approach, Sixth Edition, 2017, Pearson
- Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol. 1-3, CRC Press LLC.
- B. A. Forouzan: Data Communications and Networking, Fourth edition, TMH Publishing. Company Ltd.
- Basta, W.Halton, Computer Security: Concepts, Issues and Implementation, Cengage Learning India.

Warana University, Warananagar. S.Y.B.Sc. (Computer Science) - Sem –IV Course Type:OE.(T) Course Code: 2502USCSOE402 Course Title: Digital Marketing II		
Teaching Scheme 02 Hours /Week	No. of Credits 2	Examination Scheme IE :10 Marks UE:40Marks
Prerequisites - Digital marketing requires creativity and problem-solving abilities. - Experience with social media platforms (Facebook, Instagram, Twitter, LinkedIn, etc.) is beneficial, as digital marketing		
Course Objectives - To understand Digital Marketing as the most powerful marketing tool. - To Learn to create digital marketing artworks. - To use social media sites like Facebook, Instagram, Twitter, LinkedIn, and others to raise sales, engage customers, and establish your brand.		
Course Outcomes On completion of the course, student will be able to– 1: Understand and learn marketing strategies and results effectively to stakeholders. 2: Assess and enhance digital marketing campaigns' return on Investment. 3: Analyze and implement practical experience with industry-standard digital marketing tools. 4: Analyze and use variety of social media channels to create and interact with communities, raise awareness of a brand.		
Course Contents		
Chapter1	Online Consumer Behavior Analysis	8 Hours
1.1 Consumer Behavior 1.2 Segmentation and Targeting online customers 1.3 Psychological Responses 1.4 Social Trends		
Chapter2	Social Media Marketing	8 Hours
2.1. Social Media Sites 2.2. - Influence of Social Media Marketing 2.3. Power of Social Media 2.4. Monetization through Social Media		

Chapter3	Future of Digital Marketing	8 Hours
3.1. Use of Artificial Intelligence (AI) in Digital Marketing. 3.2. Common use of household gadgets for online marketing. 3.3. Digital Marketing strategies.		
Case Study		6 Hours
Case Study 1 Experiential Learning: Creating a website. Case Study 2 Online Consumer Behavior Analysis for an E-Commerce Fashion Brand		
Reference Books:		
1	Digital Marketing: Nitin Kamat, Chinmay Kamat (Himalaya Publishing House)	
2	"Digital Marketing for Dummies" by Ryan Deiss and Russ Henneberry	
3	"Influence: The Psychology of Persuasion" by Robert B. Cialdini	
4	"Social Media Marketing Workbook: How to Use Social Media for Business" by Jason McDonald	

Warana University Warananagr, S.Y.B.Sc. (Computer Science) - Sem – IV Course Type: CEP Course Code: 2502USCSCEP401 Course Title :Mini Project		
Teaching Scheme 2 Hours /Week	No. of Credits 4	Examination Scheme IE : 10 marks UE: 40 marks
Prerequisites ER Modeling		
Course Objectives 1. To get knowledge and understanding of software engineering discipline. 2. To learn analysis and design principles for software project development. 3. Implement Agile Development Methodologies in real life Software Projects.		
Course Outcomes On completion of the course, student will be able to- 1: Identify requirements, analyze and prepare models. 2: Understand basic SW engineering concepts and Process models. 3: Compare and chose a process model for a software project development. 4: Design different UML Diagrams.		
Course Contents		
Assignment No	Title	No of hours
1	Preliminary Investigation and Requirement Specification	2 Hours /Week
2	Design of a system	
3	Database Design	
4	Input and Output Screen layout	
5	Coding and Implementation	

WaranaUniversity ,Warananagar S.Y.B.Sc. (Computer Science)SemIV Course Type: AEC(II) Course Code: 2502USCSAEC402 Course Title: English		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE: 10 marks UE: 40 marks

AS per Syllabus University Basket

WaranaUniversity , Warananagar S.Y.B.Sc. (Computer Science) Sem IV Course Type: VSC Course Code: 2502USCSVSC402 Course Title: Environmental Studies		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE: 10 marks UE: 40 marks

AS per Syllabus University Basket

WaranaUniversity ,Warananagar
Question Paper Nature
 S.Y.B.Sc. (Computer Science)
 Sem III and Sem IV

Total Marks -40

Q1	Fill in the blanks and rewrite the sentences.	16 M
1	vccfjghrgjgtrkg	
2	cvbcbbnnhnh	
4	vccfjghrgjgtrkg	
5	cvbcbbnnhnh	
6	vccfjghrgjgtrkg	
7	cvbcbbnnhnh	
8	cvbcbbnnhnh	
Q2	Explain the brief questions (any 4)	16 M
1	vccfjghrgjgtrkg	
2	cvbcbbnnhnh	
3	vccfjghrgjgtrkg	
4	Cvbcbbnnhnh	
5	vccfjghrgjgtrkg	
Q3	Explain the brief questions (any 2)	08 M
1	vccfjghrgjgtrkg	
2	cvbcbbnnhnh	
3	vccfjghrgjgtrkg	
4	Cvbcbbnnhnh	