Prof. Ram Meghe Institute Of Technology And Research Badnera -Amravati

**An Autonomous Institute
Affiliated to Sant Gadge Baba
Amravati University, Amravati,
Maharashtra (India)**

PROGRAMME SCHEME & SYLLABUS

2024-2025 - Onwards

MASTER IN COMPUTER APPLICATIONS

Two Year Post Graduate Degree Program in Master in Computer Applications Choice Based Credit System (Semester Pattern)

			Teaching Scheme					Examination Scheme											
			Hours/ Week					THEORY							PRACTICAL				
										Internal					Max. Marks				
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total Hours/ Week	Credits	Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Max. Marks MSE/ MSIE	Max. Marks TA	Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Int.	Ext.	Total	Min. Passing Marks
Theory																		
01	1SMC01	Computer Organization and Architecture	4			4	4	3	60	30	10	100	24	40				
02	1SMC02	Data Structures using C++	4			4	4	3	60	30	10	100	24	40				
03	1SMC03	Probability and Statistical Methods	4			4	4	3	60	30	10	100	24	40				
04	1SMC04	Computer Networks and Security	4			4	4	3	60	30	10	100	24	40				
Practical																		
05	1SMC05	# Professional Communication			2	2	1								50	…	50	25
06	1SMC06	Web Designing Lab		1	2	3	2								25	25	50	25
07	1SMC07	Object Oriented Programming (OOP) Using Java- Lab	1		4	5	3								25	25	50	25
08	1SMC08	Data Structures and Algorithms Lab			2	2	1								25	25	50	25
		Total	18		10	28	23					400					200	

Note : # - Grading will be Based on Continuous Evaluation.

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Theory																		
01	2SMC01	Operating Systems and Virtualization	4			4	4	3	60	30	10	100	24	40				
02	2SMC02	Database Systems	4			4	4	3	60	30	10	100	24	40				
03	2SMC03	Resource Management Techniques	4			4	4	3	60	30	10	100	24	40				
04	2SMC04	Elective 1	4			4	4	3	60	30	10	100	24	40				
Practical																		
05	2SMC05	Elective 1 Lab			4	4	2								25	25	50	25
06	2SMC06	Operating Systems and Virtualization Lab			2	2	1								25	25	50	25
07	2SMC07	Minor Project based on Database Systems and Web Designing			4	4	2								50	50	100	50
		Total	16		10	26	21					400					200	

Elective 1
2SMC04-i   Python Programming
2SMC04-ii   System Administration and Security
2SMC04-iii Client Server Computing

Exit Option - Student has to earn 8 credits based on (Excluding list of courses studied in first and second semester):-	
Two relevant MOOC / NPTEL courses as decided by BOS-8 credits	**Courses should be selected from following areas –** Artificial Intelligence / Machine Language / UI-UX design/Cloud computing/ Block Chain/ Cyber security
OR	
Internship (Min 120 Hrs) -8 credits	

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			Teaching Scheme					Examination Scheme												
			SEMESTER:III																	
			Hours/ Week							THEORY						PRACTICAL				
Sr. No.	**Subject Code**	**Subject**	**Lecture**	**Tutorial**	**P/D**	**Total Hours/ Week**	**Credits**	**Duration of paper (Hrs)**	**Max. Marks ESE/ ESSE**	**Internal**		**Total**	**Min. Passing Marks in ESE/ ESSE**	**Overall Min Passing Marks**	**Max. Marks**		**Total**	**Min. Passing Marks**
										Max. Marks MSE/ MSIE	**Max. Marks TA**					**Int.**	**Ext.**		
Theory																			
01	3SMC01	Cloud computing	4			4	4	3	60	30	10	100	24	40				
02	3SMC02	Artificial Intelligence	4			4	4	3	60	30	10	100	24	40				
03	3SMC03	Cyber Securityand Digital Forensics	4			4	4	3	60	30	10	100	24	40				
04	3SMC04	Elective 2	4			4	4	3	60	30	10	100	24	40				
Practical																			
05	3SMC05	Elective 2 Lab			2	2	1								25	25	50	25
06	3SMC06	Artificial Intelligence Lab			2	2	1								25	25	50	25
07	3SMC07	Cloud computing Lab			2	2	1								25	25	50	25
08	3SMC08	Cyber Security and Digital Forensics Lab			2	2	1								25	25	50	25
		Total	**16**		**8**	**24**	**20**					**400**					**200**	

Elective-2
3SMC04-i Data Analytics and Machine learning
3SMC04-ii Software Architecture and Project Management
3SMC04-iii Internet of Things

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Sr. No.	Subject Code	Subject	Teaching Scheme - Hours/Week Lecture	Tutorial	P/D	Total Hours/Week	Credits	THEORY Duration of paper (Hrs)	Max. Marks ESE/ESSE	Internal Max. Marks MSE/MSIE	Max. Marks TA	Total	Min. Passing Marks in ESE/ESSE	Overall Min Passing Marks	PRACTICAL Max. Marks Int.	Ext.	Total	Min. Passing Marks
SEMESTER:IV
Project and Internship/Startup (Track Based)
01	4SMC01	**A)** Stage- I Presentation					2								25	--		
		B) Stage -II Presentation					2								25	--	250	125
		C) Marks given by company , OR C) Stage -III Presentation for Startup					4								100	--		
		D) Final Presentation, Viva Voce					8								--	100		
02	4SMC02-i)	Swayam /NPTEL course on Human Values and ethics					4	Swayam / NPTEL exam									50	25
		OR
	4SMC02-ii)	Paper publication (in Computer Science and Engg.) in blind peer reviewed journals					4	Paper published									50	25
		Total					20										300	

Available Tracks :-

Track Code	Track Title	Domain
4SMC01-A	Software Engineering & Product Development	Technical
4SMC01-B	Data Science, AI & Machine Learning	Technical
4SMC01-C	Cloud Computing, DevOps & Cybersecurity	Technical
4SMC01-D	UI/UX and Human-Centric Computing	Creative Domain
4SMC01-E	Embedded Systems, IoT & Smart Devices	Emerging Technologies
4SMC01-F	Startup / Entrepreneurship Projects	Entrepreneurial
4SMC01-G	Research & Innovation	R&D-Oriented

Summary of Marks and Credits					
Year	Sem	Sem Marks	Yearly Marks	Sem Credit	Yearly Credit
First	I	600	1200	23	44
	II	600		21	
Second	III	600	900	20	40
	IV	300		20	
Total			2100		84

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SYLLABUS OF MASTER IN COMPUTER APPLICATIONS 1ˢᵗ Year Sem I

Course Code	Course Title	L	T	P	C
1SMC01	**Computer Organization and Architecture**	04	00	00	04

Course Learning Objectives:
1. Students should understand basic organization, design, and programming of a simple digital computer and its basic architectural concepts.
2. Students should be able to analyze data transfer and instruction execution for various components of a microprocessor and for different microprocessor architectures.
3. Students should understand the parallel execution of instructions in different architectural types.

Course Outcomes:
Students will be able to –

1. Understand the basics of computer architecture.
2. Understand fundamentals of parallel processing and pipeline processing,
3. Analyze and classify different pipelined processors, with architectural features of advanced processors.
4. Analyze the memory communication and its use in processor architecture.
5. Evaluate the types of interconnections between the processors.
6. Analyze the Multithreaded architecture and data communication between computers.

	Subject: Computer Organization and Architecture	L
UNIT I	Amdahl's law, Von Neumann machine architecture, Program development tools, Operating systems. Design of ALU, Bit slice processors. Concept of instruction formats and instruction set, instruction set types, types of operands and operations, Generation of memory addresses and addressing modes, Subroutine nesting using stacks to implement subroutine calls and calling conventions, Processor organizations, Register organization, Stack based organizations, Encoding of machine instructions, General features of RISC and CISC instruction sets.	9
UNIT II	Overview of Parallel Processing and Pipelining Processing, study and comparison of uni-processors and parallel processors. Conventional	9

	and EPIC architecture. Overview of Parallel Processing and Pipelining Processing Necessity of high performance, Constraints of conventional architecture, Parallelism in uniprocessor system, Evolution of parallel processors, future trends, Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture. Basic principles of scalable performance: Performance Metrics and Measures.	
UNIT III	Instruction pipeline, instruction pipeline hazards, overcoming hazards using a pipeline with forwarding paths, instruction set design influence on pipelining, example of pipelined CISC processor, example of pipelined RISC processor, VLIW (Very Long Instruction Word) processors, Vector processors, Multithreaded processors, Compilation techniques support to instruction level parallelism, Extracting parallelism	9
UNIT IV	Protection between programs running on the same system, accessing I/O devices, programmed I/O, interrupts, direct memory access DMA, bus arbitration, interface circuits, I/O interfaces, I/O processors, external I/O devices. Multiprocessor Architectures – Objectives, Introduction, Multiprocessor Architectures, Performance Characteristics of Multiprocessors, Multicore Architectures – Single Chip Multiprocessors, Flynn Classification, Interconnection Structures	9
UNIT V	Interconnection Networks – Dynamic and Static Multiprocessor System Interconnects, Banyan and Delta Networks (Banyan Multistage Networks), Interprocess Arbitration, Interprocess Communication, Memory Organization in Multiprocessors, Shared-memory Multiprocessor Systems, Synchronization – Memory Organization, Contention and Arbitration, Cache Coherence and Synchronization Mechanisms, Cache Coherence, Message Passing Systems.	9
UNIT VI	Study of Architecture of Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions. Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming, Shared Memory Programming, Data Parallel Programming. Implementation issues of a multithreaded program.	9
	Total	54

Text Books :
1. Computer Architecture and Organization by Nicholus Carter & Rajkamal, Schaum Series Pub.
2. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill International Edition

Reference Books :
1. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill
2. V. Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.
3. William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall, Sixth edition.
4. Kai Hwang, Scalable Parallel Computing.
5. Harrold Stone, High performance computer Architecture.
6. Richard Y. Kain, Advanced Computer Architecture
7. http://www.intel.com/products/processor (for Intel Itanium Processor)

Course Code	Course Title	L	T	P	C
1SMC02	**Data Structures using c++**	04	00	00	04

Course Learning Objectives:
1. Students should understand linear and nonlinear data structures and solve various computing problems through appropriate use of learned data structure.

Prerequisite   ➢ Basic knowledge of C++ .

Course Outcomes:
Students will be able to –

1. Learn array data structure and perform operations on array.

2. Learn linked list data structure and perform operations on linked list.

3. Learn stack, queue data structure and perform operations on stack, Queue.

4. Learn Tree data structure and perform operations on Tree.

5. Learn Graph data structure and perform operations on Graph.

6. Apply specific sorting and searching methods depending upon factors like type of data, volume of data and develop Critical Thinking Skills

	Subject: Data Structures using c++	**L**
UNIT I	**Arrays**: Arrays, Arrays the Abstract Data Type, Array Representation, Multidimensional, Operations on Arrays Traversal ,Searching, Insertion and Deletion, Sorting-Bubble Sort , Vector and Matrix, Application of Arrays-Matrix Multiplication, sparse matrices.	9
UNIT II	**Linked lists**: Introduction to Linked List and their representation in memory, traversing a linked list, searching a linked list, Memory allocation & garbage collection. Insertion deletion operations on linked lists. Header linked lists,Two- way linked lists.	9
UNIT III	**Stacks** : Introduction to Stacks, Stacks as Abstract Data Type, Representation of Stacks through Arrays **Applications of stacks**: Arithmetic expressions: Polish notation, conversion of Infix to Postfix Expression, Evaluation of Postfix Expression Recursion, Towers of Hanoi . **Queues**: Introduction to Queues, Queues as Abstract Data Type, Representation of Queue through Arrays and Linked list, Circular Queues Deques. Priority queues.	9
UNIT IV	**Trees:** Introduction to Binary trees, Types of trees, Representation of Binary trees in memory, Searching a Node, Insertion of a node, Deletion of a nodeTraversing binary trees. Traversal algorithms using stacks, Header nodes :threads, Heap, Heap Sort	9
UNIT V	**Graphs**: Introduction to Graph, Terms Associated with Graphs, Types of Graph, Sequential representation of graphs, Linked representation of Graphs, Traversal of graph-Depth first Search, Breadth First Search, warshall's algorithm for shortest path	9
UNIT VI	**Sorting**: Insertion Sort, Selection Sort, Quick Sort, Radix Sort and their efficiency, Complexity of algorithms. **Hashing:** Introduction, Hash Function, Collision in hashing, Hashing: HashFunction, Collision Resolution	9
	Total	54

Text Books :

1. Data Structures through C++,ISRD Group,McGraw Hill

2. Seymour Lipschutz: "Data Structures ", Schaum's Outline Series

Reference Books :

1. "Data structure algorithms and Applications in C++" : Sartaj Sahani (Second Edition Universities Press

2. "Data structure" - Tenenbaum 6. "Data structure and algorithm analysis in C++ ": Mark Allan Welss, Addison Wesley

Course Code	Course Title	L	T	P	C
1SMC03	**Probability and Statistical Techniques**	04	00	00	04

Course Learning Objectives:

1. Perform analysis of sequence, series of real numbers and their convergence, continuity, differentiability of real valued functions and apply statistical & standard distributions
2. To apply variety of probability and non probability sampling methods for selecting a sample from a population.

Course Outcomes:

Students will be able to –

1. Understand the foundations of mathematics.

2. Apply mathematical ideas to model real-world problems.

3. Analyze data using Statistical Methods

4. Identify the type of statistical situation and solve statistical Problems

5. Use discrete and continuous probability distributions, including Requirements, mean and variance, and making decisions.

6. Identify the characteristics of different discrete and continuous Distributions.

	Subject: Probability and Statistical Techniques	L
UNIT I	Measures of central Tendency: Arithmetic mean, Weighted mean, Median, Mode, Quartiles, Deciles and Percentiles. Locating median and quartiles through Ogives. Histogram to locate mode and mean. Numerical problems on central tendency Measures ofDispersion: Range, Quartile deviation, Mean deviation from mean, Standard deviation and their coefficients. Numerical problems on Range, quartile deviation, mean deviation.	9
UNIT II	Skewness, Correlation & Regression:- Karl Pearson's coefficient of Skewness, Bowley's coefficient of Skewness, Scatter Diagram, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient , Linear Regression and Estimation, Coefficients of regression	9

UNIT III	Introduction to Probability:-Random experiment, Sample space, Events, Axiomatic Probability, Algebra of events Elementary ProbabilityTheory: Concept of random experiment/trial and possible outcomes; Sample Space and Discrete Sample Space; Events their types, Algebra of Events, Mutually Exclusive and Exhaustive Events, Complimentary events.Classical definition of Probability, Addition theorem (without proof), conditional probability. Simple examples	9
UNIT IV	Conditional Probability:- Conditional Probability, Multiplication theorem of Probability, Independent events, Baye's Theorem Random variables:- Discrete random variable, Continuous random variable, Two-dimensional random variable, Joint probability distribution, Stochastic independence	9
UNIT V	Bivariate Linear Regression: Finding Regression lines by method of least squares. Properties of Regression Coefficients- i) $r = \sqrt{b_{yx}b_{xy}}$ ii) $(\bar{x}, \bar{y})$ is the point of intersection of two regression lines. Numerical problems on BivariateLinear Regression. Time series :Definition of Time series & uses of time series. Components of Time series, Additive & multiplicative models. Methods of estimating trend by moving average method graphical method, semi- average method & by least square methods. Numerical problems on Time Series	9
UNIT VI	Testing of Hypothesis:-Hypothesis, Type I and Type II errors. Tests of significance – Student's t-test:Single Mean, Difference of means, paired ttest, Chi-Square test:Test of Goodness of Fit, Independence Test	9
	Total	54

Text Books :
1. Linear Algebra and its Applications by David C Lay, Pearson
2. Business Mathematics by KashyapTrivedi, ChiragTrivedi, Pearson

Reference Books :
1. Fundamentals of Mathematical Statistics – 1st Edition S.C.Gupta, V.K.Kapoor , S Chand
2. Introduction to Probability & Statistics – 4th Edition J.Susan Milton, Jesse C.Arnold Tata McGraw Hill
3. Fundamentals of Statistics : 7th edition S C Gupta, Himalaya Publishing house
4. Probability and Statistics with Reliability, Queuing, And Computer Science Applications (English) 1st Edition: KishoreTrivedi, PHI

Course Code	Course Title	L	T	P	C
1SMC04	**Computer Networks and Security**	04	00	00	04

Course Learning Objectives:

    1. Understand fundamentals of networking concepts with the help of layered architecture which includes OSI and TCP/IP model

    2. Know the principles of congestion control and trade-offs in fairness and efficiency, network security, network management, sensor networks etc

Course Outcomes:

Students will be able to –

    1. To familiarize the student with the basic taxonomy and terminology of computer networks
    2. Learn sockets programming and how to implement client/serverprograms.

    3. Know the concepts of reliable data transfer and how TCP implements these concepts
    4. Understand the basics of error detection including parity, checksums, andCRC

    5. To prepare the student for advanced courses in computer networking.

    6. Familiarize the student with current topics such as security, network management, sensor networks, and/or other topics.

	Subject: Computer Networks and Security	L
UNIT I	Introduction: Brief history of computer networks & Internet, Basic Model of Communication System; *Data Transmission*: Modes: Simplex, Half Duplex, Full Duplex; Methods/*Types*: Parallel, Serial: Asynchronous, Synchronous, Isochronous; *Transmission Media:* Guided and unguided; *switching***:** Circuit, Message, and Packet, Layered architecture, Internet protocol stack,. Delays in Packet Switched Network. *Models***:** ISO-OSI model.	9
UNIT II	*Application layer*: Principles of protocols, *Processes***:** Client-Server Model, Socket Interface; Services required by Application Layer; *HTTP***:** Introduction, RTT, HTTP Handshake, *FTP***:** Service Model. Electronic Mail; SMTP, HTTP, FTP, SMTP and DNS protocols. Network topologies, Types of Networks: LAN, MAN, WAN.	9
UNIT III	Transport Layer: Services; Multiplexing and Demultiplexing Applications; Connectionless Transport – UDP; Principles of Reliable of Data Transfer (RDT); Connection-Oriented Transport: TCP; Flow Control; Principles of Congestion Control; Approaches towards Congestion Control; TCP Congestion Control	9

UNIT IV	**Network Layer:** Services; Network Service Model: Datagram, Virtual Circuit; Routing Principles; Routing Algorithms: Classifications; Hierarchical Routing; Internet Protocol: IP and ICMP; Routing in the Internet: RIP, OSPF, BGP; Router.	9
UNIT V	Data Link Layer: Introduction, Services; Error Detection and Correction; Multiple Access Protocols: ALOHA, CSMA/CD; LAN Addresses and Address Resolution Protocol ARP; Carrier Sense Multiple Access / CD Ethernet; Hubs, Bridges and Switches; Point- to- Point Protocol.	9
UNIT VI	Network security issues, Network security components, principles of cryptography, authentication & authentication protocol, integrity, digital signatures, Network Management: principles, infrastructure for network management, The Internet Network – management framework.	9
	Total	54

Text Books :

1. Data Communication and Networking – Behrouz A. Forouzan (McGrawHill), . James F. Kurose & K W Ross: Computer Networking,

2. Pearson Education (LPE) REFERENCES: . Douglas E. Comer: Computer Network& Internet, Addison Wesley. . Andrew S. Tanenbaum :

3. Computer Networks, PHI (5E) . Leon Garcia & Widjaja: Communication Networks, TMH . William Stallings: Data & Computer Communication, Pearson Education.

Reference Books :

1. Computer Networking –James F. Kurose and Keith W. Ross(Pearson)

2. Data Communication and Networking –Behrouz A. Forouzan(McGrawHill)

3. Computer Network & Internet - Douglas E.Comer(Pearson)

4. Data and Computer Communication – William Stallings(Pearson)

Course Code	Course Title	L	T	P	C
1SMC05	**Professional Communication**	00	00	02	01

Course Learning Objectives:

1. Understand the various techniques of professional communication and apply them.

Course Outcomes:

Students will be able to –

1. Understand the types of professional communication and correspondence

2. Comprehend the processes like receiving, filing and replying

3. Implementation of effective techniques in presentation and socialnetwork.

Activity	Sample Activity List	L
I	**Before Speak! Think or Write** Introduction and Importance of communication in mode of speaking,writing, speaking.	4
II	**Make a group, Always in a group** Group activity like – group discussion brainstorming the topic – questioning and clarifying – GD strategies, Debate, Problem solving techniques using positive communication	6
III	**Express your skill** Need of presentation, making PowerPoint presentation, Paper Presentation, Report writing, Interview etiquette (dress code – body language – attending job interviews).	8
IV	**Time and Network** Managing time-managing stress- networking professionally-respectingsocial protocols-understanding career management	6
	Total	24

Reference Materials:
1. Effective Communication - Introduction to Communication Skills - Communication Skills - https://www.youtube.com/watch?v=W-4IcNJIyM8&list=PLvbKJaHKFw3ZYTp2Fc9cj2LwZtIbOd5ux
2. How to improve Communication Skills? By Sandeep Maheshwari I Hindi - https://www.youtube.com/watch?v=hE6I9apUvrk
3. Public Speaking Skills | Boost your Confidence | Ankur Warikoo
4. https://www.youtube.com/watch?v=savwVzZh5go

Course Code	Course Title	L	T	P	C
1SMC06	**Web Designing Lab**	00	01	02	02

Course Learning Objectives:

1. After completion of this course the students will be able to develop dynamic web pages using HTML ,Cascading Style Sheets and Javascript .

Course Outcomes:

Students will be able to –

1. Learn and use mark-up language HTML and Scripting language CSS.
2. Work with JavaScript and develop UI/UX design.
3. Develop skills of basic web development and design professional web pages.

Sr. No.	Contents
	Write programs based on **HTML** Lists ,Tables ,Images ,Forms, Buttons, Audio ,Video, DatePicker **Cascading Style Sheet:** -Font Properties , Background properties , Border properties ,text properties ,margin properties, padding properties ,table properties, positioning properties , line/marker properties. **JAVASCRIPT :** control structures, predefined keywords - arrays ,predefined functions , user defined functions – arrays and functions – mathematical functions , string functions ,objects ,expressions ,pattern matching using RegEXp ,String Class ,Exception Handling ,Built–in objects , Bgcolor/ Fgcolor, Date Object, Events and Event Handling ,Validations , Window Confirmation, alert messages, lambda expression

Sample of Practical List	P
The sample list of programs given below. This list can be used as guideline for problem statements. Aim of the list is to inform about minimum expected outcomes. 1) Cerate a web page using text formatting tags like<H><p><hr>
<font><b>,<i> etc 2) Create a webpage which displays the use of table 3) Create a webpage which displays the use of ordered and unordered list 4) Create a employee registration webpage using html form objects. 5) Create Web Pages for online shopping site and use inline, internal and external css. 6) Write a Javascript program that uses different control structure. 7) Write a Javascript program that performs validations on html form fields. 8) Write a Javascript program to demonstrate the use of functions. 9) Write a Javascript program to demonstrate the use of lambda expression 10) Write a JavaScript code to study the String object and various methods 11) Implement few programs using tools like DreamViewer, Bootstrap	39
Total	39

TEXT BOOK:
1. HTML 5 Black Book, Covers CSS3, JavaScript, XML, XHTML,AJAX, PHP and jQuery, 2nd Edition 2016 2. Javascript A Beginners Guide, 3rd Edition – John Pollock - Tata McGraw-Hill Edition 3. Raj Kamal, Internet and Web Technologies, Tata McGraw Hill

Reference Materials:

1. https://developer.mozilla.org/en-US/docs/Learn/HTML

2. https://developer.mozilla.org/en-US/docs/Web/CSS/Tutorials

3. www.tutorialspoint.com
4. www.javatpoint.com

Course Code	Course Title	L	T	P	C
1SMC07	**Object Oriented Programming(OOP) Using Java Lab**	01	00	04	03

Course Learning Objectives:

1. Students should be able to implement and appreciate the paradigms of object oriented programming using Java

2. Students should understand concepts of multithreading and exception handling and be able to write simple programs based on them

3. Students should understand the Collection framework and know the difference between different data structures in collection framework

Course Outcomes:

Students will be able to –

1. Write OOP using java

2. Write programs for file handling

3. Write programs using appropriate collection frameworks

	Sample of Practical List	**P**
	Write test and debug programs based on: Java loops, conditionals, classes, inheritance, abstract classes, interfaces, packages, access control in packages, exception handling, multithreading, file handling, lambda expressions, and diligently use various data structures from the collection framework. **Sample of Practical List** Student may perform at least 10 practical (including one small project based on core java concept) 1 WAP in java to Print Given	61

Output

A. 10101   B.   1
   01010   232
   10101   34543
   01010   4567654
               567898765

2 Write a Program that accepts integer input and covert the given integer number to Binary or Hexadecimal.

3 WAP in java which read the string from command line argument and check the string for vowels and prints the string without the vowels.

4 WAP that has a class with overloaded member function (add) . One add takes double arguments and the other takes int arguments. The add member function should display all the arguments it takes and also display their sum Run the program by providing different number of arguments(NOTE: use VarArgs). Run the program atleast 10 times with different number of arguments and take 10 outputs.

5 Create an abstract class Fig3d with a data member dim1 and an abstract function vol(). Create 2 classes sphere and cylinder and that inherit Fig3d. These classes should implement the vol() function. Add this program to a package.

6 WAP in java that Creates an Interface figure2d with member function area(). Write two classes named "rectangle" and "triangle" that implements the above interface and display the area of the figure.

7 Write a Program in java that Generates two set of 10 random numbers and divides a number from one set with one from the another set. Anticipate the kind of exception that will be generated and catch it.

8 WAP in java that takes your birth date as input from the command line. Check if the date is valid. If yes, check if it is less than today's date. If not generate an exception created by you, with a proper message that birthdates should be less than today's date. If proper date is entered display the age

9 WAP in java that Creates Two Threads, set there Priorities (High to Low) and Shows the number of CPU Cycles allotted to each thread. Make a use of join() Method.

10 WAP in java to Display the Use of Synchronized Method
    Synchronized Block

11 WAP in java to Copy the Content of one file to the other file without using any looping statements. Read the Name of the file from the command line

	12 WAP in Java that reads and displays its own contents. 13 Write an application program in Java using Switch statements to print A-Z, a - z,0-9 by inputting ASCII value of first character. 14 Write an application in Java which creates an Address Book class which manages collection of person object and allows programmer to add, delete , search a Person object in the Address Book using Collection Framework.	
	Total	61

TEXT BOOK:	
	1. **1. Herbert Schildt – *Java: The Complete Reference* (Latest Edition, McGraw Hill)**

REFERENCE BOOKS/URLs:	
	1. Kathy Sierra & Bert Bates – *Head First Java* (O'Reilly) 2. Cay S. Horstmann – *Core Java Volume I – Fundamentals* (Prentice Hall) 3. E. Balagurusamy – *Programming with Java* (McGraw Hill)
	4. Oracle Java Tutorials (Official): https://docs.oracle.com/javase/tutorial/ 5. Java Collections Framework Guide (Baeldung): https://www.baeldung.com/java-collections

Course Code	Course Title	L	T	P	C
1SMC08	**Data Structures using C++ Lab**	00	00	02	01

Course Learning Objectives:-

1. To enable students to effectively implement fundamental data structures and enhance their problem-solving skills through practical programming and algorithm analysis.

Course Outcomes:

1. Develop program for implementing different data structure such as array, linked list ,stack, queue, tree and graph for operations such as searching , Inserting, deleting, Sorting.

2. Identify and use various data structures for solving problem.
3. Perform Analysis of algorithms.

	Sample of Practical List	P
	The sample list of programs given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes. 1. Write a program to implement Searching Algorithm i) Linear Search ii) Binary Search 2. Write a program to implement Sorting Algorithm i) Bubble Sort ii) Selection Sort iii) Insertion Sort 3. Write a program to perform i) Addition of Matrix ii) Multiplication of Matrix 4. Write a program to implement Array (Insertion, Deletion & Searching operation)	24

	5. Write a program to implement Linear Linked List (Insertion ,Deletion &Searching operation) 6. Write a program to implement Stack (PUSH, POP, DISPLAY Operations) 7. Write a program for towers of Hanoi using Recursion. 8. Write a program to implement Queue (Insertion, Deletion) 9. Write a program to implement Tree Traversal Algorithm (Inorder, Preorder, Postorder) 10. Write a program to implement Graph using Adjacency Matrix.	21
	Total	24

Course Code	Course Title	L	T	P	C
2SMC01	**Operating Systems and Virtualization**	04	00	00	04

Course Learning Objectives:

1. Understand the mechanisms of the Operating Systems like Process Management, Process Synchronization storage Structures used in OS and apply the mechanism to resolve deadlocks.

2. Implement memory management, disk and process scheduling techniques

3. To Understand the most common hardware features that support virtualization and explain how they are used by operating system modules.

Course Outcomes:

Students will be able to –

1. Understand the concept of programs & processes along with the need of scheduling in operating systems

2. Recognize different states of process and schedulers to apply scheduling algorithms to meet the scheduling objectives and acquire the knowledge of dealing with deadlocks.

3. Apply memory management techniques & virtual memory concepts to avoid page faults and computing page replacement strategies

4. Analyze and apply file system allocation methods and file recovery techniques.

5. Evaluate I/O Subsystem, DISK management and RAID techniques.

6. Apply hypervisor techniques to build virtual environment for network system.

	Subject: Operating Systems and Virtualization	L
UNIT I	Introduction: Operating System (OS) definition, OS Evolution, OS Components and Services. Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multi-threading Models, Threading Issues.	9

UNIT II	CPU Scheduling Concepts, Scheduling Criteria and Algorithms. Process Synchronization: The Critical-Section Problem, Synchronization Hardware, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock.	9
UNIT III	Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation. Virtual Memory Management: Background, Demand Paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing.	9
UNIT IV	File-System Interface; Directory structure, File-System Mounting, File Sharing & Protection. File-System Structure, File-System Implementation. Directory Implementation, Allocation Methods, Free-Space Management. File Recovery	9
UNIT V	I/O Systems: Overview, I/O Hardware, Application I/O Interface, and Kernel I/O Subsystem. Transforming I/O to Hardware Operations. Disk Scheduling, Disk Management, Swap – Space Management, RAID Structure.	9
UNIT VI	Virtualization: Introduction, Types of virtualizations, Linux KVM, VM Manager, Kimchi Project, SDN, Performance tuning in KVM, Implementing Type II hypervisor (Virtual Box), Installation of Guest OS and firewall configuration.	9
	Total	54

Text Books :

1. Avi Silberschatz , P.B.Galvin, G. Gagne : "Operating System Concepts"

2. Larry T. Vaughn- Client/Server System Design and Implementation- McGraw-Hill

3. Humble chirammal - Mastering KVM virtualization – Packt Publication

Course Code	Course Title	L	T	P	C
2SMC02	**Database Systems**	04	00	00	04

Course Learning Objectives:

1. Design relational data models.

2. Use SQL, and other database supporting software for designing and querying databases.

3. Implement security and integrity policies related to databases.

Course Outcomes:

Students will be able to –

On completion of the course, the students will be able to
1. Comprehend the fundamental elements of relational database management systems
2. Query the databases using SQL and write stored procedure and functions.
3. Design database using the E-R Model
4. Understand basic database storage structures and access techniques
5. Implement accuracy and integrity using transaction properties.
6. Apply the concepts of database for parallel and distributed databases.

Units	Contents	Total Hrs
I	Database System Applications, Purpose of Database System, View of Data, Database Languages, Database Design, Database Engine, Database and Application Architecture, Database Users and Administrators, Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, The Relational Algebra.	9
II	Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Index Definition in SQL, Authorization, Accessing SQL from a Programming Language, Functions and Procedures, Triggers.	9
III	Database Design Using the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Complex Attributes, Mapping Cardinalities, Primary Key, Removing Redundant Attributes in Entity Sets, Reducing E-R Diagrams to Relational Schemas, Extended E-R Features, Entity-Relationship Design Issues Relational Database Design: Features of Good Relational Designs, Decomposition Using Functional Dependencies, Normal Forms, 1NF, 2NF, 3NF, Boyce-Codd Normal Form, 4NF, Functional- Dependency Theory, Algorithms for Decomposition Using Functional Dependencies,	9
IV	Physical Storage Systems: Overview of Physical Storage Media, Storage Interfaces, Magnetic Disks, Flash Memory, RAID, Disk-Block Access. Data Storage Structures: Database Storage Architecture, File Organization, Organization of Records in Files, Data-Dictionary Storage, Database Buffer, Column-Oriented Storage, Storage Organization in Main-Memory Databases.	9

V	Indexing: Basic Concepts of Indexing, Ordered Indices, B+-Tree Index Files, Creation of Indices. Transactions: Transaction Concept, Simple Transaction Model, ACID properties Storage Structure, Transaction Atomicity and Durability, Transaction Isolation Serializability, Transaction Isolation and Atomicity.	9
VI	Concurrency Control: Basic concept of concurrency control, introduction of Protocols Database-System Architectures: Overview of Centralized Database Systems, Server System Architectures, Parallel Systems, Distributed Systems, Transaction Processing in Parallel and Distributed Systems, Cloud-Based Services. Introduction to Big Data.	9
	Total	54

Text Books :

    1. Silberschatz, Korth, Sudarshan : Database System Concepts , McGraw Hill, 7th Edition

Reference Books :

1. Raghu Ramkrishnan :Database System (TMH)

2. C.J.Date : Database System, 7th ed,.(Pearson Education)

3. Connolly & Begg, : Database System, Low Price Ed. (Pearson Education)

4. Navathe & Elmarsi , Fundamentals of Database Systems. 4/e (Pearson Education).

Course Code	Course Title	L	T	P	C
2SMC03	**Resource Management Techniques**	04	00	00	04

Course Learning Objectives:

1. Students should acquire a systematic understanding of resource management techniques and apply them for optimization of resources in reallife problems.

2. The students should be able to make decision using systematic process and techniques

Course Outcomes:

Students will be able to –

1. Use transportation problem solving techniques to optimize transportation problem.
2. Apply job scheduling techniques for effective production management and allocation of resources.
3. Apply decision making techniques to help individual, poor or strong financial firms.
4. Apply network scheduling techniques to improve the production management.
5. Solve dynamic programming problem and calculate replacement age of equipment that deteriorate with time.
6. Simulate real life situation into a mathematical model using LPP.

	Subject: Resource Management Techniques	L
UNIT I	**Transportation Problem:** Introduction to transportation problem, mathematical model, types of transportation problem, Optimization techniques for transportation problem, methods to find basic solution, Northwest Corner cell Method (NWCM), Least Cost cell Method (LCM), Vogel Approximation Method (VAM). Optimizing the basic feasible solution using U-V method.	9
UNIT II	**Sequencing Problem:** N Jobs and Two machine sequencing Problems, N joband three machine sequencing problem. **Assignment Problem:** Introduction, zero-one programming model forAssignment problems, type of assignment problems.	9
UNIT III	**Decision Theory:** Introduction to decision theory, minimax, minimin, maximin and maximax decision procedure, Bayes decision procedure. Regret function versus loss function. **Game Theory:** minimax, maximin, pure strategies, mixed strategies & expected payoff, solution of 2 × n games, m × 2 games. Brawn's Algorithm	9

UNIT IV	**Network Analysis:** Critical Path Method (CPM), Critical Path, Time estimates as EST, EFT, LST and LFT and Floats. Project Evaluation and Review Technique (PERT) Network, ET, TE, TL, SE,critical path, probability of completing events on schedule.	9	
UNIT V	**Dynamic programming problems:** Introduction, Terminology, Bellmans Principle of Optimality, Applications of dynamic programming-shortest path problem, Investment problem. **Equipment replacement problems**: Introduction , Types of Failure , Replacement of items that deteriorate with time	9	
UNIT VI	**Linear Programming Problems:** Introduction, concept of linear programming model, Formulation of Linear Programming Problem, Graphical Method, Simplex Method, Big M Method, Two phase Method.	9	
	Total	54	

Text Books :

1. J.K. Sharma " Operation Research" (2/e)Macmillan.

2. R.Panneerselvam "Operation Research"PHI.

3. Operations Research, KantiSwarup, Gupta. P. K. & Man Mohan, S. Chand & Sons.

Reference Books :

1. Tata Hamdy, " Operations Research- An Introduction" (5/e), PHI.

2. Taha H. A. "Operation Research"Macmillan.

Course Code	Course Title	L	T	P	C
Elective 1 2SMC04-i	**Introduction to Python Programming**	04	00	00	04

Course Learning Objectives:

1. Students should understand Python programming constructs and be able to write simple python programs using them.

2. Students should understand various data structures and numpy and pandas packages of Python and be able to use them for a given problem statement

Course Outcomes:

Students will be able to –

1. Use basic functionalities of Python

2. Know and apply various data structures of Python

3. Understand exception handling, decorators, Generators

4. Use multithreading and multiprocessing

5. Use numpy functions and methods on given data

6. Use pandas functions and methods on given data

	Subject: i) Introduction to Python Programming	L
UNIT I	Why Python? Install Python on Windows, various IDEs used for Python Programming. Numbers, Strings, Lists, variables, if statement for loops, functions, lambda functions Programming problems on all topics	9
UNIT II	Data Structures: Sets, Dictionaries, Tuples, List Comprehensions, Modules: Installing modules, creating modules, using modules, working with JSON, Reading Reading/Writing Files, Understanding_____main___	9
UNIT III	Exception handling, Classes and objects, Inheritance, Multiple Inheritance Iterators, Generators, Decorators, command line arguments	9
UNIT IV	Introduction to Multithreading, Multiprocessing, Sharing data Between processes, Multiprocessing lock, Multiprocessing pool	9

UNIT V	Numpy: Introduction, Creating arrays: single to multi dimensional, attributes of Numpy Array: ndim, shape, size, dtype, itemsize, Numpy functions: zeroes, ones, empty, zeros_like, ones, ones_like, empty,set_printoptions. arrange, reshape, Basic Array Operations :min, max, cumsum, sqrt, exp, add, Statistical order functions, averages , variance, covariance, correlation, Nan equivalent functions Indexing, slicing and iterating arrays, changing the shape, stacking, splitting of arrays, Random Generators and seeds, Basic Random functions, Probably distributions in Numpy, Reading data from csv,excel,text files	9
UNIT VI	Pandas: Introduction to Pandas, data structures in pandas:Series, DataFrame, reading excel,csv,tsv,table data into a data frame, reading data from a data frame back into a table,reading data from a DataFrame, Deleting external data, selecting rows and columns from DataFrame, Creating new columns from existing, rename row/column names, Summary statistics: mean, median, aggregating statistics by category: groupby, value_counts, count, loc, iloc, reshape table layout: sort_values, long to wide format(pivot) and viceversa(melt),Concatenating and merging objects, Handling Time Series Data, textual Data	9
	Total	54

Text Books :

1. Martin C. Brown- Python: The Complete Reference-Fourth Edition-Mc-Graw Hill-2018

Reference Books :

1. John V. Guttag, Introduction to Computation and Programming Using Python: with Application to Computational Modelling and Understanding Data- Third Edition- MIT press- 2021.
2. Paul J. Deitel- Harvey Deitel- Python for Programmers- First Edition- Pearson- 2020.

Course Code	Course Title	L	T	P	C
Elective 1 2SMC04-ii	**System Administration and Security**	04	00	00	04

Course Learning Objectives:

1. Students should understand principles, and practices and goals of system administration and the major approaches to computer management in the network environment.

2. Students should be able to implement Network OS administration techniques and management techniques to provide security.

Course Outcomes:

Students will be able to –

1. Integrate a biblical world view within information technology, also Describe threats to information security

2. Examine the primary components of administrative domains. Identify methods, tools and techniques for combating these threats

3. Identify types of attacks and problems that occur when systems are not properly protected

4. Analyze applications to solve organizational needs. also Explain integral parts of overall good information security practices

5. Identify and discuss issues related to access control

6. Identify security issues related to personnel decisions, and qualifications of security personnel

	System Administration and Security	**L**
UNIT I	Introduction to network security, Introduction to System Administration, Definition and role of system administration, Key responsibilities and skills of system administrators, Overview of different operating systems and their administration tools, Network Fundamentals, Introduction to computer networks and network topologies, Network services and protocols, Network device management (routers, switches, firewalls)..	9

UNIT II	Computer security concepts, OSI Security architecture, Security attacks, Passive and active attacks, Understanding threats: Internal Threats, External Threats, Security Attacks, authentication, integrity, access control, A model for network security, Standards, Cryptography: Symmetric Encryption Principles: Cryptography; Cryptanalysis; Feistel Cipher Structure.	9
UNIT III	Symmetric Block Encryption Algorithms: Data Encryption Standard; Triple DES; Advanced Encryption Standard, standardization process, Key distribution, public key cryptography principles, digital signature, and internet standards, Symmetric key distribution using symmetric encryption, Network security applications: Kerberos, Key Distribution Using Asymmetric Encryption, X.509 certificate	9
UNIT IV	Transport-level security, Web security considerations, secure socket layer, and transport layer security, System Security: Intruder, Intruder Behavior Patterns, and Intrusion Techniques, Intrusion Detection, Password Management, Password Protection, password selection strategies, Password Complexity, Types of Password Attacks, IP Security: Overview, Web Security.	9
UNIT V	Malicious software, Types of Malicious Software, Introduction to Viruses Stages of Viruses Life, and Working of Viruses, Indications of Viruses attack Types of Viruses, viruses and related threats: Nature of viruses Viruses Classification, Computer Worms, Dos attack, and various antivirus approaches, Virus detection methods, Virus and worms countermeasures, Firewall, Need for firewall.	9
UNIT VI	Network Management Security: Basic concepts of SNMP, Ethical Hacking, Types of Hackers, Skills required for an Ethical Hacker, Types of Attacks, Social Engineering, Behaviors Vulnerable to attacks, Why is Social Engineering Effective, Warning Signs of an Attacks, Denial of Service Attack, Symptoms of DoS attack, Botnets, Introduction to Cyber Crime Investigation, Cyber Law & IT Act.	9
	Total	54

Text Books :

1. Network Security Essentials - William Stallings (Pearson Edu. Asia),

2. Cryptography and Network Security: Principles and Practice, 4th edition,

3. Pearson Education, India. 2. William Stallings (2000),

4. Network Security Essentials (Applications and Standards), Pearson Education, India.

Reference Books :

1 Security for Telecommunication and Network management by Moshe Rozenbit (PHI)

2. Internet Security Protocols - Protecting IP Traffic, by Uyless Black (Pearson Edu. Asia

3. Charlie Kaufman (2002),   Network Security: Private Communication in a Public World, 2nd edition, Prentice Hall of India, New Delhi.

Course Code	Course Title	L	T	P	C
ELECTIVE 1 2SMC04-iii	**Client Server Computing**	04	00	00	04

Course Learning Objectives:

1. Provide a sound foundation to the students on the concepts and practices used in Client Server Computing using java as the language, so that the students are able to put into use the advanced features of Java language to build and compile robust enterprise grade applications using advanced concepts like Servlets , JSP, Beans, JDBC, Hibernate and Spring.

Course Outcomes:

Students will be able to –

1. Write JDBC Code to access and manipulate database data
2. Write servlets, JDBC servlets and understand and use techniques of session handling
3. Write JSP and also use JSTL
4. Use Javascript for client side validations.
5. Use hibernate and appreciate it as compared to JDBC.
6. Use MVC with spring and implement the server side programs in MVC framework

Pre-requisite of course: Knowledge of Core Java

		<mark>Client Server Computing</mark>	L
UNIT I		**Java Database Connectivity:** JDBC Concepts, JDBC API, Driver Manager,Connection,Statement, PreparedStatement, CallableStatementand ResultSet classeswith relevant methods, Types of ResultSets.Handling queries, inserts, deletes and updates to database.Displaying the query results. Stored Procedures.	9

UNIT II	**Servlets in Java:** Servlet structure & lifecycle. Servlet A P I basics, various classes & interfaces. Servlet requirements, writing. Running of Servlets, Concepts of Cookies, Servlets & cookies. Session management with ServletAPI. Server side includes and request forwarding.Servlet chaining. Jdbc Servlets.	9	
UNIT III	**Introduction to JSP:** Simple JSP concepts, Environment set up for JSP, Life cycle of a JSP, Elements involved with development of JSP: Scripting Elements,Directives, Implicit Objects. Java beans: Concept of Beans, Properties, Bean instances & serialization, Bean Scopes, Writing Beans, Deploying a bean, JDBC bean. Jsp Actions, Using a bean in a JSP. Java StandardTagLibrary(JSTL/AdvancedJSP):Typesoftags,coreandSQ Ltags in detail.	9	
UNIT IV	**Introduction to Javascript**: What is Javascript?, Values, Types and Operators Expressions and statements, control flow statements, Functions, Arrow Functions HTTP and Forms, Event handling, data Structures, objects, Regular Expressions	9	
UNIT V	**Introduction to Hibernate:** Why Hibernate?, Architecture of Hibernate, Hibernate Query language,Hibernate O/R Mapping,Setting up the Development Environment ,Creating Database TableWriting-> Hibernate Configuration File, JavaBean, and Hibernate Mapping File, Developing Controller Component,Developing view Component	9	
UNIT VI	**Introduction to Spring**: Spring MVC essentials. Architecture & workflow features, Maven repository ,Dependency Injection (IoC), Spring Beans & Bean factory. Spring controller & annotations AOP (Aspect oriented programming) Spring boot,Auto configuration & Maven dependency management. Sprin initializer, Actuators, Spring data JPA, application.properties(hibernate),Spring REST. GET & POST services, Introduction to Microservices and serverles computing.	9	
	Total	54	

Text Books :

1. Java Server Programming Java EE 7 (J2EE 1.7) Black Book(2014) KogentLearningSolutionsInc.

2. Core Servlets and Java Server Pages: Core Technologies by Marty Hall and Larry BrownJava 2 Platform Enterprise Edition series, PrenticeHall

Reference Books :

1. Java EE cookbook, Elder Moraes,Packt Publishing Limited (9 April 2018)

2. Reference URLs: www.docs.oracle.com www.tutorialspoint.com www.javatpoint.com

3. Suggested Resource for unit VI: https://spring.io/guides

Course Code	Course Title	L	T	P	C
2SMC05-i	**Elective 1 Lab-I: Python Programming Lab**	00	00	04	02

Course Learning Objectives:

1. To develop proficiency in Python programming using built-in data structures, modules, and exception handling techniques.
2. To enable students to apply Python for data processing and analysis using multithreading, NumPy, and Pandas.

Course Outcomes:

1 Learn to write, test, and debug simple Python programs, Loops and Conditionals, Use OOP concepts in Python programs

2. Read and write data from/to files in Python. String Operations, BasicData structures

3. Understand and Use the Numpy and Pandas packages.

	Sample of Practical List	P
	1. Tasks Based on Numbers ,Strings, methods and manipulation of String in Python. 2. Tasks Based on conditions and loops 3. Tasks Based on lists 4. Logical Tasks like: Conversion of roman numerals to decimal	48

	5. Tasks Based on lists and Tuples	35
	6. Tasks Based on List Comprehensions, conditional statements	
	7. Tasks Based on modules and exception handling	
	8. Tasks Based on Modules in python	
	9. Task: Based on OOP in Python	
	10. Task: Based on File handling in Python	
	11. Tasks Based on Generator	
	12. Tasks Based on decorator	
	13. Tasks Based on Multithreading and Multiprocessing	
	14. Task: Based on Multithreading and multiprocessing in Python	
	15. Task Based on Multiprocessing in Python	
	16. Tasks Based on Numpy package	
	17. Tasks Based on pandas package	
	Total	48

Course Code	Course Title	L	T	P	C
2SMC05-ii	**Elective 1 Lab-II: System Administration and Security-Lab**	00	00	04	02

Course Learning Objectives

1. To provide practical knowledge of installing, configuring, and managing modern operating systems (e.g., Linux) and their core services in a lab environment.
2. To enable students to master fundamental system administration tasks, including user and group management, file system administration, process management, and resource monitoring.
3. To introduce students to a variety of security principles and tools, including firewalls, intrusion detection systems, and vulnerability scanners, and demonstrate their practical application.

Course Outcomes:

1 Comprehend and apply authentication, email security, web security services and mechanisms

2. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to various attacks.

3. Identify and know security risks, concepts, Ethics in Network Security. Identify and classify various Attacks and explain the same. Discuss the effectiveness of passwords in access control.

	Sample of Practical List	**P**

	Topics covered in LAB Hours:-
	
	1. About Linux OS.
	2. Introduction to Linux Shell (BASH)
	3. Linux Network configuration & setup using network tools.
	4. System administrator & User management.
	5. Maintaining linux file system.
	6. File and service sharing (SAMBA & NFS)
	7. Configure client side DNS.
	8. Perform security
	   administration
	   tasksa)Network
	   Trouble shooting
	   b) Firewall setup
	   c) GRUB & BIOS Setup
	9. Securing data with encryption.
	10. Linux Server Configuration.
		48

	Total	48

Course Code	Course Title	L	T	P	C
2SMC05-iii	**Elective 1 Lab- III -: Client Server Computing Lab**	00	00	04	02

Course Learning Objectives:

1. To introduce client-server concepts and develop applications using JDBC, Servlets, JSP, and JavaScript.
2. To build skills for creating enterprise applications using Spring and Hibernate based on user requirements.

Course Outcomes:

1. Design and Develop Desktop application using JDBC

2. Design and Develop applications by Integrating any of Servlets, JSPs, JDBC and JavaScript

3. Design and Develop applications by integrating Spring, hibernate by analyzing requirements and evaluating existing system.

	Sample of Practical List	**P**
	The sample list of programs is given below. This list can be used as a guideline but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes. Write program TO: 1. Create a database, table/tables, in the database using JDBC 2. Insert, Update, delete records from database table based on conditions 3. Display the records in database table based on conditions 4. Write servlet programs to manipulate table data 5. Write a servlet program in Java that calls a stored procedure. 6. Write a small application that performs state management using Cookies, 7. Write a small application that performs state management using Http Session 8. Create a registration form with validations using javas cript 9. Write a java script program to validate Roman numerals, mobile number, email 10. Write programs that manipulate database tables using JSP,JSTL 11. Rewrite few of the above JDBC based programs using hibernate 12. Create a small application using Spring and hibernate	48
	Total	48

Course Code	Course Title	L	T	P	C
2SMC06	**Operating Systems and Virtualization Lab**	00	00	02	01

Course Learning Objective:

1. Develop proficiency in operating system and virtualization fundamentals.
2. Acquire skills in cloud infrastructure management and service evaluation.
3. Design secure and efficient IT systems

Course Outcomes:

1. Understand and analyze features of the Ubuntu operating system and its shell environment.
2. Apply shell programming concepts to perform file management, user management, and process-related operations.
3. Develop and implement shell scripts to simulate OS scheduling algorithms and system-level resource handling.

	Sample of Practical List	**P**

	1. Case Study on – Ubuntu Operating system
	
	    • Origin of Ubuntu OS (Debian)
	    • Version details of Ubuntu OS – up to current version
	    • Tools used in Ubuntu OS (GIMP, Libre etc)
	    • What is GCC? What is shell programming?
	    • State and explain different types of Shell.
	    • What is Terminal ? how to use command on Terminal ?
	    • State and explain different basic shell command with syntax.
	
	2. Write a shell script program for calculator using select case statement.
	
	3. Create a text file using vi editor, use insert / command / execute mode
	
	    • What is Vi editor – version
	    • Explain Modes of VI
	    • Create BIO data in VI
	    • Steps to save file on system
	
	4. Write a shell script to display details of running process and threads in system
	
	    A. Enter p for process details
	    B. Enter t for threads details
		24

5. Write Shell script program to check whether given file is a directory or not.		
6. Write a shell script program to display list of users currently logged in.		
7. Write a shell script to assign file permission to given file / folder.		
8. Write a shell script to implement round robin Scheduling Algorithm		
9. Write a shell script to implement FCFS Scheduling Algorithm.		
10. Write a Shell script to implement deadlock prevention.		
11. Install a Type II hypervisor and share virtual file instance between host and guest OS		
Total		24

Course Code	Course Title	L	T	P	C
2SMC07	**Minor Project based on Database Systems and Web Designing**	00	00	04	02

Course Learning Objectives:
1. To make the students to set the industrial exposure.
2. To implement the knowledge of database systems & web designing and apply innovative and creative ideas for solving real world problems in order to get industry like exposure.

Course Outcomes:
1. Apply basic and advanced SQL commands to manage relational databases.
2. Utilize SQL functions and joins to retrieve and manipulate data efficiently.
3. Develop and execute PL/SQL stored procedures for automated data processing and develop project

	Sample of Practical List	**P**
	1. Implementation of DDL commands of SQL with suitable examples 2. Implementation of DML commands of SQL with suitable examples	48

	3. Implementation of different types of functions with suitable examples. 1. Number Function 2. Conversion Function 3. Date Function 4. Implementation of different types of functions with suitable examples. 5. 5Character Function, Conversion Function, Date Function on EMPLOYEE Table. 6. Study & Implementation of Group by & Having Clause, Order by Clause 7. Create a simple View in the database to get specific information as per given problem statments. 8. Creating Database/ Table / Users/Roles 9. Managing Users: - Create User, Delete User • Managing Passwords • Managing Privileges: - Grant , Revoke 10. Implementation of different types of operators in SQL like Arithmetic Operator Logical Operator Comparison Operator Special Operator Set Operator 11. Implementation of different types of Joins 12. • Inner Join • Outer Join • Natural Join 13. Consider the following schema for a Library Database and solve the given problem statements regarding different SQL functions 14. To study Stored Procedure in PL-SQL witout using any parameters to get different data from the tables 15. To study Stored Procedure in PL-SQL and execute the following queries (using parameters): 16. Create a Stored Procedure to store the data in table Employee 17. b) Create a Stored Procedure to update the data of table Employee1. **Develop a small project using HTML, CSS, Python/Java, MySQL/Data analytics tools**	
Total		48

SYLLABUS OF MASTER IN COMPUTER APPLICATIONS 2nd Year SEMESTER III [Two Years]

Course Code	Course Title	L	T	P	C
3SMC01	**Cloud Computing**	04	00	00	04

Course Learning Objective:-

1. To provide foundational knowledge of cloud computing concepts, models, services, and benefits(Mapped from CO1 and CO4)
2. To develop skills in virtualization, cloud resource management, and storage techniques using modern platforms and tools(Mapped from CO2, CO3, and CO5)
3. To enable learners to evaluate and implement cloud security practices, identity management, and compliance standards in virtualized environments (Mapped from CO6)

Course Outcomes:

Students will be able to –

1. Understand the core concepts of cloud computing and its benefits along with its various models and services in cloud computing.

2. Implement and manage virtual machines using hypervisors like VMware or KVM, and optimize resource utilization in cloud environments

3. Compare block-level and file-level storage virtualization techniques and assess their benefits in a virtualized data centre

4. Evaluate cloud service offerings from platforms like AWS, Google Cloud, and Microsoft Azure, selecting the best platform for specific infrastructure needs

5. Design a cloud management system using software-defined techniques to monitor and manage IT resources efficiently

6. Assess security risks in cloud environments and recommend best practices for identity management and compliance with global standards

	Subject: Cloud Computing	**L**
UNIT I	**Introduction to Cloud Computing** Introduction, Defining Cloud Computing, Understanding Cloud Architecture, Benefits of Cloud Computing SOA, Utility computing, Hardware virtualization, Essentials of Cloud characteristics, Challenges, Role of Networks in Cloud Computing: Cloud types and	9

	service models, Cloud computing reference model		
UNIT II	**Virtualization** Introduction, Understanding Abstraction & Virtualization Technologies, Virtualization, Types of Virtualizations, Pros and Cons of Virtualization, Technology examples: Xen, KVM, VMware, Virtual Box, Load Balancing & Virtualization, Understanding Hypervisors, Servers and instance types, Network Capacity, Scaling.	9	
UNIT III	**Storage in Cloud** Storage system architecture, Big data, Virtualize data center (VDC) architecture, VDC Environment, server, storage, networking, Virtual Machine Components and Process of converting physical to VMs, Block and file level storage virtualization, VLAN, VSAN and benefits, Network traffic management techniques in VDC, Cloud file systems: GFS and HDFS.	9	
UNIT IV	**Cloud computing platforms & Standards** Infrastructure as Service, cloud infrastructure components, Anatomy of Cloud infrastructure, Distributed management of virtual infrastructure, scheduling techniques, Google Web Services, Amazon Web Services, Microsoft Cloud services. Cloud Computing Standards Objectives, Best Practices and Standards.	9	
UNIT V	**Cloud monitoring and management** Introduction and architecture for federated cloud computing, Performance prediction for HPC on Cloud. SLA management service catalogue, cloud portal and its functions, cloud interface standards, system integration and work-flow modelling, cloud service life-cycle phases, software defined approach and techniques for managing IT resources.	9	
UNIT VI	**Security in Cloud Computing** Introduction, Global Risk and Compliance aspects in cloud environments. Data security risk, Cloud computing and identity, Digital identity and access management. Cloud Applications, Research trend in Cloud Computing, Fog Computing, Open Source and Commercial Clouds, Cloud Simulator.	9	
	Total	54	

Text Books :

1. Barrie Sosinsky,"Cloud Computing", Wiley India.
2. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication.
3. RajkumarBuyya, "Mastering Cloud Computing", Tata McGraw Hill.

Reference Books :

1. Greg Schulr,"Cloud and virtual data storage networking", CRC Press.
2. Anthony T. Velte, "Cloud Computing, A Practical Approach", TATA Mc Graw Hill
3. Pachghare V. K.,"Cloud Computing", PHI Learning
4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.

Course Code	Course Title	L	T	P	C
3SMC02	**Artificial Intelligence**	04	00	00	04

Course Learning Objectives:

1. Introduce foundational concepts of Artificial Intelligence (AI)

2. Equip students with problem-solving, reasoning, and learning techniques

3. Develop understanding of AI algorithms, search strategies, and knowledge representation

4. Encourage the application of AI concepts using Python and open-source tools

Course Outcomes:

Students will be able to –

1. Describe the foundational concepts, applications, and domains of Artificial Intelligence.
2. Formulate and analyze AI problems using appropriate search strategies and performance evaluation techniques.
3. Demonstrate knowledge representation techniques and reasoning using rule-based and logic systems.
4. Implement basic machine learning models and evaluate their performance using real-world datasets.
5. Develop simple NLP-based systems such as chatbots or sentiment analyzers using no-code/low-code tools.
6. Analyze ethical implications of AI in various domains and explore its societal impact and career prospects.

	Subject: Artificial Intelligence	L
UNIT I	**Introduction to Artificial Intelligence:** The Foundations of Artificial Intelligence, The History of Artificial Intelligence, and the State of the Art. Intelligent Agents: Introduction, How Agents should Act, Structure of Intelligent Agents, Environments.	9

UNIT II	**Solving Problems by Searching**: problem-solving Agents, Formulating problems, Example problems, and searching for Solutions, Search Strategies, Avoiding Repeated States, and Constraint Satisfaction Search. Informed Search Methods: Best-First Search, Heuristic Functions, Memory Bounded Search, and Iterative Improvement Algorithms.	9
UNIT III	**Agents That Reason Logically**; A Knowledge-Based Agent, The Wumpus World Environment, First-Order Logic; Syntax and Semantics, Extensions and National, Variations, using First Order Logic, Logical Agents for the Wumpus World, A Simple Reflex Agent	9
UNIT IV	**Building a Knowledge Base**; Properties of Good and Bad Knowledge Bases, Knowledge Engineering. The Electronic Circuits Domain, General Outology, The Grocery Shopping World. Inference in First-Order Logic : Inference Rules Involving Quantifiers, An Example Proof.	9
UNIT V	**Planning** A Simple Planning Agent Form Problem Solving to Planning. Planning in Situation Calculus. Basic Representations for Planning. A Partial-Order planning Example, A partial Order planning algorithm.	9
UNIT VI	**Machine Learning :-** Machine Learning Concepts, methods and models, Supervised Learning, unsupervised and semi-supervised, Learning Decision Trees.	9
	Total	54

Text Books :

1. Elaine Rich, Kevin Knight – *Artificial Intelligence*, McGraw-Hill
2. Stuart Russell & Peter Norvig – *Artificial Intelligence: A Modern Approach*, Pearson
3. Ethem Alpaydin – *Introduction to Machine Learning*
4. Python Documentation, Scikit-learn tutorials

Course Code	Course Title	L	T	P	C
3SMC03	**Cyber Security and Digital Forensics**	04	00	00	04

Course Learning Objectives:

1. Understand the fundamental concepts of cyber security, threats, vulnerabilities, and cyber laws.

2. To develop students that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets.

3. Learn methods and tools used to secure networks, systems, and applications from cyber attacks.

4. Understand fundamental concepts of cyber security, cyber crimes, and ethical hacking. Explore ethical hacking techniques and penetration testing methodologies.

Course Outcomes:

Students will be able to –

1. Identify and analyze risks, threats, and vulnerabilities connected to computer networks.
2. Conduct a cyber security risk assessment.
3. Understand the basic terminology of cybercrimes.
4. Analyzing Organizational implication and security risks and perils for organizations
5. Perform basic penetration testing and analyze system security using appropriate tools. Acquire knowledge of privacy issues and principles of law in cyber crime
6. Understand the basics of digital forensics and Analyze digital evidence data. Demonstrate knowledge of cyber laws, digital rights, and ethical practices in cyber security.

	Subject: Cyber Security and Digital Forensics	L
UNIT I	Network and Security Concepts, Introduction to Cyber security, Importance of Cyber Security, Cyber security Strategy, Need of Cyber security, Security components, Difference between Authentication and Authorization, Risk, threat and Vulnerabilities, Common threats: A brief overview, Malwares and its types, Adware Ransomware & spyware, Social Engineering Frauds.	9
UNIT II	Kinds of cyber crimes- Cyber Bullying, Cyber Stalking, Dark Web, Vulnerabilities, Risk Assessment and Risk Management, Guidelines for secure password, Generating secure password, Wireless security, Email and social media security, Cyber Safety Tips, Internet Security Myths, essential cyber	9

	security terms, security holes in your system,	
UNIT III	Attacker Techniques and Motivations, How and Why Attackers Use Proxies, Types of Proxies, Fraud Techniques- Phishing, Smishing, Vishing., Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Credit card Frauds in Mobile and Wireless Computing Era, Authentication service Security.	9
UNIT IV	Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications from cloud computing, social media marketing: social computing and the associated challenges for organizations. Understanding intellectual property.	9
UNIT V	Privacy Issues: Data Privacy Concepts, Data Privacy Attacks, Cyber forensic, Historical Background of Cyber forensics, Why should we report cyber crime, Some recent cyber crime incidents, Counter cyber security initiatives in India, Introductory principles of law and legal research, Cyber security awareness and education.	9
UNIT VI	Digital Forensics: Introduction, Need for digital forensics, The Digital Forensics Process, Investigation, Digital evidence collection, Roles of International Law, National Cyber Security Policy, Digital Forensics Lifecycle, Challenges in Computer Forensics, Cyber Safety Tips, Solving a Computer Forensics Case, Forensic best practices for organization.	9
	Total	54

Text Books :

1. Cyber Security - Edited By Thomas A Johnson CRC Press.

2. CYBER SECURITY By Dr. Krishan Kumar Goyal, Prof Amit Garg

3. The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics by IzzatAlsmadi

4. Computer Forensics and Digital Investigation with EnCase Forensic v7 By SuzanneWidup

5. Digital Forensics for Network, Internet and Cloud computing By Cunt PGarrison

6. The Cyber Security Body of Knowledge Version 1.0

Reference Books :

1. Digital Forensics for Network, Internet and Cloud computing By Cunt PGarrison

2. The Cyber Security Body of Knowledge Version 1.0

3. Introduction to cyber security..by Jitendra Pande

4. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015

5. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015

6. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017

7. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.

Course Code	Course Title	L	T	P	C
3SMC04-i	**Elective 2 : Data Analytics and Machine Learning**	04	00	00	04

Course Learning Objectives:

1. To provide a foundational understanding of data analytics concepts, data preprocessing techniques, and the modern data ecosystem.
2. To develop practical skills in applying machine learning algorithms, creating visualizations, and performing data analysis using Python and SQL.

Course Outcomes:

Students will be able to –

1. Understand the meaning of Data Analytics, Its types and few techniques
2. Know and apply various Python packages to perform various steps in data cleaning and preprocessing and make it ready for analysis
3. Understand and implement common supervised learning techniques
4. Understand and implement common unsupervised learning techniques
5. Use Python Visualization tools
6. Implement data analytics using SQL

	Elective 2 : Data Analytics and Machine Learning	L
UNIT I	Introduction of Data Analytics and Data Analysis: The difference between Data Analytics and Data Analysis. The role of Data Engineers, Data Analysts, Data Scientists and Business Analysts. The different types of data analysis. The key steps in a data analytics process. A modern data ecosystem: The different components of a modern data ecosystem. The role of Business Intelligence Analysts in this ecosystem. The role, responsibilities, and skillsets required to be a Data Analyst.	9

UNIT II	Data Preprocessing using Pandas: Handling Missing values(using SimpleImputer), reshaping, sorting shuffling, striping values, concatenating, finding unique values in nd Arrays,Encoding categorical data: One Hot Encoding, Label Encoding (suggested modules: sklearn.preprocessing.OneHotEncoder, sklearn.compose.ColumnTransformer,sklearn.preprocessing.LabelEncoder), splitting the dataset into train and test data(preparing data for ML algorithms), suggested module->sklearn.model_selection, Feature scaling(suggested StandardScaler class)/ Feature Engineering	9
UNIT III	Introduction to Machine Learning: Introduction to learning methods and their types,Supervised Learning: Understanding Linear and logistic regression, Decision Trees, Random Forest, Support Vector Machines, K Nearest Neighbours algorithms, Steps in supervised learning Data preprocessing and mining, Implementation of these algorithms using Python, Advantages and Disadvantages of Supervised Learning algorithms	9
UNIT IV	Unsupervised Learning: How it works, types of Unsupervised learning Algorithms: Clustering, Association Rule Learning, Dimensionality Reduction, Python implementation of K Means Clustering, Apriori Algorithm, Reinforcement Learning, Time Series Analysis	9
UNIT V	Data Visualization: Understanding and interpreting regression plots, scatter plots, box plots, bar charts, histograms, stack plots. Creating these plots and combination plots using matplotlib or seaborn. Analyzing plots, Accuracy of a Machine Learning Model, Using Plots to test the accuracy of your ML models, Confusion Matrix	9
UNIT VI	Data Analytics using Sql: Retrieving data using SELECT, Using functions to customize the output, Data manipulation statements, Joins, subqueries, Common Table Expressions(CTE), Data management and manipulation, Windows Functions	9
	Total	54

Resources at:
1. https://www.geeksforgeeks.org/machine-learning/ 2. https://pandas.pydata.org/docs/, 3. https://scikit-learn.org/ , 4. https://www.python.org

	Recommended Books
	Machine Learning for Absolute Beginners: A Plain English Introduction (Third Edition) by Oliver Theobald (Author) , Scatterplot Press, 2017
	Python Data Analytics With Pandas, NumPy, and Matplotlib Fabio Nelli, Third Edition, Apress
	SQL for Data Analytics - Third Edition Paperback – Import, 29 August 2022 by Jun Shan (Author,Packt)

Course Code	Course Title	L	T	P	C
3SMC04-ii	**Elective 2 – Software Architecture and Project Management**	04	00	00	04

Course Learning **Objectives:-**

1. To impart knowledge of software process models and architecture to enable students to analyze and apply suitable models and frameworks in real-world software development.
2. To develop understanding of software design principles, quality metrics, and project management techniques required for effective software development and delivery.
3. To enable students to create efficient project schedules and implement robust testing and debugging strategies to ensure high-quality software products.

Course Outcomes:

Students will be able to –

1. Analyze and apply Process model for software development.
2. Evaluate and apply the software architecture.
3. Analyze basics of software Design and Measures.
4. Understand the Project Management concepts
5. Create Project Schedule maintaining the quality of the software.
6. Create software testing and debugging strategies.

	Subject: Elective 2 – Software Architecture and Project Management	L
UNIT I	Evolving role of Software. Software crises & myths. Software Engineering. Software process & process models : Linear sequential, Incremental Model, RAD Model, Evolutionary Prototyping, Spiral Model, Concurrent Development Model, Agile Model.	9
UNIT II	What Is Software Architecture: Introduction, Architectural Structures and Views, Architectural Patterns, What Makes a "Good" Architecture, Software Architecture Stakeholders for a System and Their Interests, Architectures Influence Data Design, Architectural styles.	9
UNIT III	Component level design: Structure programming, Comparison of design notation, User-interface design: Golden Rule, Task analysis & modeling, ID activities, Tools, design evaluation. Measures, Metrics & Indicators: Measures, Metrics & Indicators, Metrics in process & project domains-software measurement, Metrics for software quality	9
UNIT IV	Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Product & Process. Project management concepts: People, Product, Process, Project. W5HH principle. Software risks : Identification, risk projection, refinement & RMMM plan.	9
UNIT V	Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 9001, SQA Plan. SCM Process. Version control. SCM standard	9
UNIT VI	Software testing fundamentals: Test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing, Debugging.	9
	Total	54

Textbook :

1. Pressman Roger. S. : Software Engineering, A Practitioner's Approach, 7th edition

2. Len Bass, Paul Clements, Rick Kazman : Software Architecture in Practice, Addison-Wesley, 3rd Edition

Reference Books :

1. Somerville : Software Engineering (Addison-Wesley) (5/e)

2. Fairly R. : Software Engineering (McGraw Hill)

3. Davis A. : Principles of Software Development (McGraw Hill)

4. Shooman, M.L. : Software Engineering (McGraw-Hill)

Course Code	Course Title	L	T	P	C
3SMC04-iii	**Elective 2 – Internet of Things**	04	00	00	04

Course Learning **Outcomes:**

1. To provide a comprehensive understanding of the fundamentals, architecture, components, and design principles of the Internet of Things (IoT).
2. To equip students with hands-on experience in developing IoT applications using Arduino microcontrollers and related programming tools.
3. To familiarize students with IoT-enabling technologies, domain-specific applications, and security issues related to the Internet of Things.

Course Outcomes:

Students will be able to –

1. Understand the use of IoT and its principles.
2. Analyze the IoT enabling Technologies .
3. Understand and use Arduino Micro-controller and IDE.
4. Design and develop IOT application using Arduino.
5. Identify the real world problems and challenges in IoT from different domains .
6. Understand various security issues related to Internet of things.

	Subject Elective 2 – Internet of Things	**L**
UNIT I	**The Internet of Things** : An Overview , The technology of the Internet of Things, Architecture of IOT,IOT key features, characteristics, Advantages, disadvantages, Enchanted Objects, Embedded Devices and system, IOT Decision framework, Design Principles for Connected Devices	9

UNIT II	**IoT Enabling Technologies -** Wireless Sensor Networks - Introduction, Components of WSN, Benefits of wireless sensor networks, applications , M2M communication, Cloud Computing , BigData Analytics, Communication Protocols	9
UNIT III	**Programming with Arduino :** Features of Arduino, Type of arduino boards, Hardware, Software, Components of Arduino Board, Arduino IDE, data types,Variables,constants,operators, Making decision with if-else, else-if, for loop, while loop, switch case, break, delay.	9
UNIT IV	**Programming with Arduino :**, Functions, passing a value to a function, returning a value from a function, Array, String ,String object ,manipulation of string , serial input,project of blinking LED, Traffic Control System	9
UNIT V	**Architecture and Domains**: Energy Domain, Biometric Domain, Security Camera and Door Unlock System, Smart Home and City, Smart Agriculture , Healthcare, Transportation, Transforming Business.	9
UNIT VI	**Security Issues** : Overview of Security Issues, Data Security , Infrastructure Security , Definition of IOT Security challenges, IOT security requirements.	9
	Total	54

Online References:

1. https://www.arduino.cc
2. www.nptel.ac.in -
3. https://youtu.be/WUYAjxnwjU4?list=PLaxu2gn-9WXMf_ln5pMvxjf043jzof4-i&t=13
   a. https://nptel.ac.in/courses/108108098/

Reference Books :

1. Internet of Things: A Hands on Approach by ArshdeepBahga and Vijay Madisetti , Universities Press, 2nd Edition
2. Internet of Things: Architecture and Design Principles by Rajkamal, McGraw Hill Education,1st edition
3. Getting Started with the Internet of Things by CunoPfister
4. The Internet of Things: Connecting Objects by HakimaChaouchi

Course Code	Course Title	L	T	P	C
3SMC05-i	**Data Analytics and Machine Learning Lab**	00	00	02	01

Course Learning **Objectives:**

1. To enable students to preprocess, analyze, and visualize data using Python, SQL, and industry-relevant tools.
2. To apply machine learning techniques for building predictive and analytical model

Course Outcomes:

1. Perform data analytics using Python, Sql

2. Make Predictions using ML with Python
3. Design interactive analytics dashboards using tools like PowerBI/Tableau

	Sample of Practical List	**P**
	Read a data set using pandas. Handle missing values. Encode categorical and nominal data. Use sklearn .	24
	Read a data set suitable for Linear regression using pandas. Apply preprocessing on the data and plot a regression line and also a scatter plot for the same. Properly label the plot . Make some predictions from the plot	
	Read a data set using pandas. Handle missing values. Apply encoding if needed and apply feature scaling.	
	Read a data set which will give a proper distribution curve using pandas. Apply preprocessing on the data and plot a histogram for the same. Properly label the plot . Analyze the plot	
	Read a data set using pandas. Apply preprocessing on the data and plot a box plot for the same. Properly label the plot . Analyze the plot	
	Create different Machine Learning models using various Supervised	

Learning			
Create different Machine Learning models using various UnSupervised Learning models			
Create different Machine Learning models using various UnSupervised Learning models			
Perform analytics on MySql dataset/s			
Design few interactive dashboards using PowerBi/Tableau			
Total			24

Course Code	Course Title	L	T	P	C
3SMC05-ii	**Elective 2 - Software Architecture and Project Management - LAB**	00	00	02	01

Course Learning **Objective**

1. To enable students to understand and apply fundamental concepts of software design and computer architecture.

2. To provide foundational knowledge of project management processes, tools, and their applications in software development.

3. To develop the ability to design effective software test cases and apply various testing strategies for software quality assurance.

Course Outcomes:

1. Apply the basic concepts software design and computer architecture.

2. Apply the basics of Project Management Concepts.
3. Design and apply Test Cases and Strategies.

	Sample of Practical List	**P**
	Design a questionare for the given project Create 3 categories of questionaries for 1] High Level Employees 2] Middle	24

	Level Employees 3] Operational Level Employees	
	Study of RAD Process Model for the given project.	
	Implementation of different architecture style on given project	
	Prepare design of product according to software design levels for the given project	
	Write different type of risks for the given project 1] Project Risks 2] Business Risks Technical Risks and prepare a RMMM plan.	
	Prepare a Gantt Chart for the given project.	
	Prepare a Test Document for the given Project (Manual Testing)	
	Write a test script on selenium using web drivers.	
	Write a script selenium to find out errors on given project.	
	Case study of mini project.	
	Total	24

Course Code	Course Title	L	T	P	C
3SMC05-iii	**Elective 2 -Internet of Things Lab**	00	00	02	01

Course Learning **Objective:-**

1. To equip students with foundational knowledge of IoT and practical skills to develop secure, Arduino-based applications across various domains.

Course Outcomes:

2. Design IoT based application interfacing with LED using Arduino.

3. Design IoT based application interfacing with temperature sensor using Arduino.
4. Design IoT based application interfacing with Active Buzzer using Arduino

	Sample of Practical List	**P**
	Study of breadboard, Arduino and other micro controller .	24
	Controlling the Light Emitting Diode (LED) with a push button.	
	Controlling the LED blink rate with the potentiometer interfacing with Arduino.	
	interfacing the RGB LED with the Arduino	
	Detection of the light using photo resistor.	
	Interfacing of temperature sensor LM35 with Arduino	
	Interfacing Servo Motor with the Arduino.	
	Interfacing of the Active Buzzer with Arduino.	
	Write a program to play a melody using tone() function.	
	Write a program to fade 12 LEDs up and the down, one by one, on an Arduino Mega board, taking advantage of the increased number of PWM enabled digital pins of this board.	
	Total	**24**

Course Code	Course Title	L	T	P	C
3SMC06	**Artificial Intelligence Lab**	00	00	02	01

Course Learning **Objective**

1. **To provide hands-on experience with no-code and low-code AI tools** for implementing fundamental AI models such as image/audio classification, chatbots, and sentiment analysis.
2. **To enable students to understand and apply various AI concepts and search strategies** by simulating intelligent agents, expert systems, and pathfinding algorithms through interactive and visual platforms.
3. **To develop awareness of real-world AI applications and ethical considerations**, encouraging students to explore tools like chatbots, Google Maps, and participate in discussions about AI's societal impact.

Course Outcomes:

1. Demonstrate the use of no-code or low-code tools to simulate basic AI models such as reflex agents, search strategies, and expert systems.

2. Design and evaluate simple machine learning and natural language applications
3. Analyze and present the ethical implications and societal impact of AI through group discussions and exploration of real-world AI tools.

	Sample of Practical List	**P**
	Write a Program to Implement Breadth First Search using Python. Write a Program to Implement Depth First Search using Python. Write a Program to find the solution for travelling salesman Problem Write a program to implement Simulated Annealing Algorithm Write a program to find the solution for wampus world problem Write a program to implement 8 puzzle problem Write a program to implement Towers of Hanoi problem Write a program to implement Hill Climbing Algorithm WRITE A PROGRAM USING function that counts the number of times a string occurs in another string: Write a function that allows you to generate random problem instances for the knapsack program USING PYTHON	24
	Total	24

Course Code	Course Title	L	T	P	C
3SMC07	**Cloud Computing Lab**	00	00	02	01

Course Learning **Objective**

1. To provide foundational knowledge of cloud computing concepts, models, services, and benefits
   (Mapped from CO1 and CO4)

2. To develop skills in virtualization, cloud resource management, and storage techniques using modern platforms and tools
   (Mapped from CO2, CO3, and CO5)

   To enable learners to evaluate and implement cloud security practices, identity management, and compliance standards in virtualized environments *(Mapped from CO6)*

Course Outcomes:

1. To Learn various hypervisor and virtualization technologies.

2. To develop instances on cloud platform.
3. To develop web applications in cloud.

	Sample of Practical List	**P**

	1. Install Virtualbox /VMware Workstation with different flavours of linux or windows OS on top of windows 10 or 11.
	2. Find a procedure to transfer the files from one virtual machine to another
	virtual machine (Guest to Guest Server system).
	3. Case Study on - AWS / Google cloud / Azure
	   • Functionality
	   • Community of customers
	   • Security
	   • Innovation
	   • Marketing
	4. Create Amazon EC2 Instance on Amazon Machine Image (AMI).
	5. Case Study on Salesforce
	   • Admin
	   • Developer
	   • Trailhead
	6. Create a Salesforce admin account and design a user-friendly dashboard.
	7. Create a custom object in salesforce account.
	8. Deploy a database in salesforce by importing csv file and perform data operations.
		24

	9. Use GAE launcher to launch the web applications. 10. Build a Serverless Web Application using AWS / Salesforce / GCS		
	Total		24

Course Code	Course Title	L	T	P	C
3SMC08	**Cyber Security & Digital Forensic Lab**	00	00	02	01

Course Learning **Objectives**

1. Familiarize students with the fundamentals of cybersecurity concepts, tools, and practical approaches to threat detection and mitigation.
2. Provide hands-on experience with ethical hacking, penetration testing, and the usage of cybersecurity tools (e.g., Nmap, Wireshark, Burp Suite, Metasploit).
3. Introduce students to digital forensic principles, including data acquisition, evidence preservation, and analysis techniques used in cybercrime investigations.

Course Outcomes:

1 Understand the implementation of various techniques and security tools.

2. Apply different tools used for secure data transmission.
3. Modern tool usage: Create, select, and apply appropriate techniques, resources.

	Sample of Practical List	**P**
	The sample list of programs given below. 1. Case study on cyber-attack/crime 2. Perform Port Scanning using Nmap 3. Perform Data Hiding Technique using OpenStego 4. Perform implementation of cyber tools and write report. 5. Case Study on current cyber security laws in India 6. Perform implementation Digital Forensic Tool 7. Perform web application scanning on test websites in ubuntu 22.10. 8. Perform network scanning using Wireshark tool and prepare a report. 9. Perform a vulnerability analysis using Nessus tools. 10. Steps to ensure security of any one web browser(Mozilla firefox,/google chrome). 11. Analysis the Security Vulnerabilities of E-commerce service.	24

	12. Analysis the security vulnerabilities of E-Mail Applications. 13. Working with KF Sensor too for creating and monitoring HONEYPOT 14. Working with NET STUMBLER to perform wireless audit on a router. 15. Working with SNORT tool to demonstrate intrusion detection system.	61
	Total	24

Course Code	Course Title	L	T	P	C
4SMC01	**Industry Project and Internship / Startup (Track Based**	00	00	00	16

Course Learning Objectives:	To familiarize students with real-world work scenarios, equipping them with the skills necessary for the professional landscape.
Course Outcomes:	On completion of the course, the students will be able to
	1. Demonstrate the ability to integrate academic concepts with professional practices by contributing meaningfully to a live industry project or startup initiative
	2. Investigate practical problems encountered during the internship and propose well-reasoned, data-driven solutions using appropriate tools or frameworks.
	3. Construct working prototypes or modules by writing efficient code and developing algorithms tailored to the specific needs of the industry/startup.
	4. Prepare clear and professional documentation, technical reports, and presentations to convey project progress and outcomes to diverse stakeholders.
	5. Reflect on ethical, social, and professional responsibilities experienced during the internship and articulate lessons learned for future growth.
	6. Demonstrate initiative, adaptability, and confidence in navigating complex real-world challenges during the course of the internship

Course Code	Course Title	L	T	P	C
4SMC02	**Swayam / NPTEL Exam Or Paper Publication**	00	00	00	04

Course Learning Objectives:	To enable students to successfully complete SWAYAM/NPTEL certification exams by enhancing their subject knowledge and self-learning skills.
	To equip students with the foundational skills required for writing and publishing academic or research papers in reputed conferences or journals.
Course Outcomes:	**On completion of the course, the students will be able to**
	1. Formulate a research problem or ethical issue relevant to computing and demonstrate the ability to conduct a structured inquiry or reflective study.
	2. Produce a scholarly research paper or successfully complete an ethics course, demonstrating clear understanding, critical thinking, and academic integrity.
	3. Communicate findings or insights effectively through technical writing or course submissions, using proper structure, references, and clarity.