D.Y.PATILTECHNICALCAMPUS

FACULTY OFENGINEERING& FACULTYOFMANAGEMENT, TALSANDE

(An Autonomous Institute)

(Approved by AICTE, New Delhi , Recognized by Government of Maharashtra &Affiliated to Shivaji University, Kolhapur)

(Accredited by NAAC'A' Gradewith3.25 CGP A in First Cycle)

SCHEME OF INSTRUCTION & SYLLABI

Programme: - Computer Science & Engineering

Semester–III (w.e.f.A.Y.2025-26)

Sr No	Course Category	Course Code	Course Title	L	T	P	Course Credits	EXAM SCHEME					
								ISE	MSE	ESE	INT	OE/POE	TOTAL
1	PCC	CSE24PCC211	Discrete Mathematical Structures	3	-	-	3	20	30	50	-	-	100
2		CSE24PCC212	Computer Networks	3	-	-	3	20	30	50	-	-	100
		CSE24PCC212P	Computer Networks Laboratory	-	-	2	1	-	-	-	25	25	50
3		CSE24PCC213	Computer Architecture and Microprocessor Systems	2	-	-	2	30	-	50	-	-	80
		CSE24PCC213P	Computer Architecture and Microprocessor Systems	-	-	2	1	-	-	-	25	-	25
4	MDM-1	CSE24MDM214	Fundamentals of Software Testing	2	-	-	2	20	-	50		-	70
5	OE-1	CSE24OE215	Privacy & Security in Online social media Software Project Management	3	1	-	4	25	-	50	25	-	100
6	CEP	CSE24CPE216P	Community Engagement Project	-	-	4	2	-	-	-	50	-	50
7	HSSM	CSE24HSSM217	Intellectual Property Rights	2	-	-	2	30	20	-	-	-	50
8	VEC	CSE24VEC218P	Applications of Data Structures	-	-	4	2	-	-	-	25	25	50
Non Credit Mandatory Course													
9	MC	CSE24MC219	Finishing School Training III	3	-	-	NC	-	-	-	50		Grade
10	CCA	CSE24CCA2110	Liberal Learning	1	-	-	NC	-	-	-	50		Grade
Total				**15**	**1**	**12**	**22**	**145**	**80**	**250**	**150**	**50**	**675**

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Department of Computer Science & Engineering

S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

Course Title :- Discrete Mathematical Structures	
Course Code:- CSE24PCC211	**Semester:- III**
Teaching Scheme L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme: ISE-I (10 Marks), MSE (30 Marks), ISE-II(10 Marks)	**ESE Marks: 50 marks**
Prerequisite-	AS24FE111-Algebra and Statistics DIC24FE121-Differential & Integral Calculus DS24FE124-Data Structure

Course Objectives:

1	To expose the students to mathematical logic related to computer science areas.
2	To enhance the problem solving skills in the areas of theoretical computer science.
3	To use mathematical concepts in the development of computer applications.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Apply logic concepts in designing a program.	Apply
2	Illustrate basic set concepts & apply operations onset.	Understand
3	Apply logic to minimize the Boolean Function.	Apply
4	Apply basic concepts of probability to solve real world problem.	Apply
5	Demonstrate to represent data structures using graph concepts.	Apply

Curriculum Details

Course Contents	Duration
Unit-I Mathematical Logic ● Statements & Notations, ● Connectives, ● Statement Formulas & truth table, ● Well-formed formulas, ● Tautologies , ● Equivalence of formulas, ● Duality law, ● Tautological Implications, ● Functionally complete set of connectives, ● Other connectives, ● Normal Forms, ● Theory of Inference for statement calculus.	**10 Hrs**
Unit-II Set Theory ● Basic concepts of set theory, ● Operations on Sets, ● Ordered pairs & n-tuples, ● Cartesian product	**05 Hrs**

Unit-III Relations & Functions ● Relations. ● Properties of binary relations. ● Matrix & Graph Representation of Relation, ● Partition & covering of Set, ● Equivalence Relations. ● Composition of Binary Relation ● POSET & Hasse Diagram, ● Functions, ● Types of Functions, ● Composition of functions.	**07 Hrs**
Unit-IV Algebraic Systems ● Algebraic Systems: Examples & general Properties, ● Semi groups & Monoids, ● Groups: Definitions & Examples, ● Subgroup & Homomorphism.	**07 Hrs**
Unit-V Lattice and Boolean Algebra ● Lattice as partially ordered sets, ● Lattice as Algebraic Systems. ● Special Lattices ● Boolean Algebra: Definitions & examples, ● Boolean Functions. ● Representation & Minimization of Boolean Functions.	**08 Hrs**
Unit-VI Graph Theory ● Basic concepts of graph theory., ● Paths, ● Reachability & Connectedness, ● Matrix, ● Representations of Graphs. ● Storage Representation & Manipulations of Graphs. ● PERT & Related technologies.	**06 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	3	2	-	-	-	-	-	-	-	2	2
2	3	3	3	2	-	-	-	-	-	-	-	2	2
3	3	3	3	2	-	-	-	-	-	-	-	2	2
4	3	3	3	2	-	-	-	-	-	-	-	2	2
5	3	3	3	2	-	-	-	-	-	-	-	2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Discrete Mathematical Structures with Application to Computer Science	--	J. P. Tremblay & R. Manohar	MGH International	--
2	Discrete Mathematics	--	Semyour Lipschutz, Marc Lipson	(MGH) Schaum's outlines	--

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Discrete Mathematics and its Applications	--	Kenneth H. Rosen	AT&T Bell Labs	--
2	Discrete Mathematical Structures	--	Bernard Kolman, Robert Busby, S.	Pearson Education	--

Useful Link /Web Resources:

1 DELNET- http://www.delnet.in

2 NDL-http://ndl.iitkgp.ac.in

3 N-LIST- http://www.nlist.inflib.ac.in

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(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Title :- Computer Networks	
Course Code:- CSE24PCC212	**Semester:- III**
Teaching Scheme L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme: ISE I (10 Marks), MSE (30 Marks), ISE II (10 Marks)	**ESE Marks: 50 marks**
Prerequisite-	CNF24FE114- Computer and Network Fundamentals

Course Objectives:

1	To illustrate the TCP/IP protocol internal details
2	To explain and learn basic internet technology protocols & Transport layer protocol
3	To perceive IPv4,IPv6 addressing and protocol
4	To understand the Client server model & socket interface

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Demonstrate TCP protocol in detail.	Understand
2	Implement network and data link layer & transport layer.	Understand
3	Learn fundamentals of Application Layer protocols.	Understand
4	Apply the principals of socket programming in the networks.	Understand
5	Understand multimedia streaming and relevant protocols.	Understand

Curriculum Details

Course Contents	Duration
Unit-I Introduction to Computer Network: • TCP/IP protocol model, Difference Between OSI model & TCP/IP Protocol suit **Data Link Layer** • Data Link Layer Design issues for Data Link Layers, • Framing methods, Error control: detection and correction, Flow control, • Elementary Data Link protocols, Sliding window Protocols, Go back n, Selective repeat. **Medium Access Control Sublayer:** • Static and Dynamic channel allocation, Multiple Access protocols ALHOA, CSMA, Collision Free Protocols • Ethernet: IEEE 802.3, IEEE 802.4, IEEE 802.5 06 standards • Wireless LANS 802.11 standards	**8Hrs**

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Unit-II Network Layer: • IPv4 Addresses: Classful Addressing Other Issues, Sub-netting and Super netting, Class less Addressing, Delivery • Forwarding and routing; Routing methods: Shortest path, Link state, Distance vector routing and broadcast routing, • Congestion control algorithms: Principles, Congestion prevention policies, congestion control in datagram subnet, Load Shedding, Jitter Control.	**8 Hrs**
Unit-III Internet Protocol: • **IPv4 Datagram format:** Fragmentation and reassembly models • ARP,RARP,ICMP, IGMP • **Next Generation IPv6 and ICMPv6:** IPV6 addresses, packet format, ICMPV6, Transaction from IPV4 to IPV6	**5 Hrs**
Unit-IV Transport Layer: • Transport Layer: The Transport service primitives, • UDP: Process to Process communication, User Datagram Format, Operation and uses of UDP. • TCP: TCP Services and Features, TCP segment format, TCP Connections, Flow and error control in TCP, TCP Timers; • Berkeley Sockets: The Socket Interface, Elementary Socket system calls byte ordering and address conversion routines, , The Client Server model and Software design, Concurrent processing in client-server software, Algorithms and issues in Client-Server design, Multiprotocol Servers, Multiservice Servers, Concurrency in clients, Unix Internet Super server (inetd).	**8 Hrs**
Unit-V Applications Layer Protocols: • **BOOTP, DHCP and Domain name system:** Name Space, Domain Name Space, Distribution of name space, and DNS in internet, Resolution, DNS massages, Types of records, Compression examples, and encapsulation. BOOTP, DHCP • **Remote Login: TELNET and File Transfer FTP,TFTP:** Concept, NVT, Embedding, Options & options/sub-option negotiation, controlling the server, Out-of-band signalling, Escape charter, Mode of operation, user interface. FTP: Connections, Communication, Command processing, File transfer, User interface, Anonymous FTP, TFTP. • **Web Applications Service Protocols: HTTP:** Architecture, Web Documents, HTTP Transaction, Request and Response, 7 HTTP Headers and Examples, Persistent Vs Non- Persistent HTTP, Proxy servers. Electronic Mail: Architecture, User agent, addresses, Delayed delivery, SMTP commands and responses, Mail transfer phases, MIME, POP3	**10 Hrs**

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Unit-VI Multimedia In Internet: • Streaming stored audio/video • Streaming live audio/video • Real time interactive audio/video • Real Time Transport Protocol (RTP) • Real Time Transport Control Protocol (RTCP) • Voice Over IP (VoIP), • Session Initiation Protocol (SIP)	**6 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO 1	3	2	3	1	1	2	-	-	3	-	-	2	-
CO 2	2	2	3	3	2	1	-	-	2	-	-	1	-
CO 3	1	2	3	1	1	-	-	-	1	-	-	2	-
CO 4	3	3	3	2	1	-	-	-	3	-	-	-	-
CO 5	1	-	2	2	1	-	-	-	2	-	-	-	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	PC Hardware Complete reference		Tata McGraw-Hill	Criage Zacker and John Rourke	
2	Data communication and Networking	4th/5th	Behrouz A. Forouzan	Tata McGraw-Hill	
3	Computer Networks		A S Tanenbaum	Pearson Education	

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Data Communications and Networking		Behrouz AForouzan		
2	Internetworking with TCP/IP		Douglas Comer		
3	Computer Networks: A Top-Down Approach		Behrouz A. Forouzan, Firouz Mosharraf	Tata McGraw-Hill Education	

Useful Link /Web Resources:

1. DELNET- http://www.delnet.in
2. NDL-http://ndl.iitkgp.ac.in
3. https://archive.nptel.ac.in/courses/106/105/106105183/
4. https://www.tpointtech.com/computer-network

Course Title: Computer Networks Laboratory

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(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Code : CSE24PCC212P	**Semester: III**
Teaching Scheme: L-T-P: 0-0-2	**Credit : 1**
Evaluation Scheme: INT: 25 Marks	**ESE/POE/OE Marks: -50**
Prerequisite-	CNF24FE114-Computer and Network Fundamentals

Course Objectives:

1	To illustrate the TCP/IP protocol internal details
2	To explain and learn basic internet technology protocols & Transport layer protocol
3	To perceive IPv4,IPv6 addressing and protocol
4	To understand the Client server model & socket interface

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Demonstrate TCP protocol in detail.	Understand
2	Implement network and data link layer & transport layer.	Understand
3	Learn fundamentals of Application Layer protocols.	Understand
4	Apply the principals of socket programming in the networks.	Apply
5	Understand multimedia streaming and relevant protocols.	Understand

List of Experiments-It should consist of 10-12 experiments based on the syllabus.

Exp. No	Title of Experiments	Duration
01	Study of following connectivity test tools with all its options–. ifconfig, arp, route, traceroute, nmap, netstat, finger	2 Hrs
02	Implementing Framing methods(Bit Stuffing/Byte stuffing/Character stuffing)	2 Hrs
03	Implementing Elementary data link protocol (Stop & waitprotocol)	2 Hrs
04	Implementation of Error detection & correction code(CRC, Hamming)	2 Hrs
05	Programs to understand IP addressing, classful & classless addressing	2 Hrs
06	Implementation of sliding window protocol..	2 Hrs
07	Implement shortest path routing algorithm.	2 Hrs
08	Client program using UDP to connect to well known services (echo, time of the day service etc.).	2 Hrs
09	Implementing concurrent TCP multiservice client/server..	2 Hrs
10	Implementing Iterative UDP client/server.	2 Hrs
11	Configuration of basic services for FTP, HTTP, Telnet etc. on LinuxPlatform	2 Hrs
12	Capturing & Analyzing operation of various application layer protocols using network protocol analyzer. (Wireshark and tcpdump)	2 Hrs

Course Articulation Matrix: Mapping of Course Outcomes (Cos) with Program Outcomes (PO's)

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PO's CO's	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO 1	3	2	3	1	1	2	-	-	3	-	-	2	1
CO 2	2	2	3	3	2	1	-	-	2	-	-	1	1
CO 3	1	2	3	1	1	-	-	-	1	-	-	-	-
CO 4	3	3	3	2	1	-	-	-	3	-	-	-	-
CO 5	1	-	2	2	1	-	-	-	2	-	-	-	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

Suggested Learning Resources: --

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	PC Hardware Complete reference		Tata McGraw-Hill	Criage Zacker and John Rourke	
2	Data communication and Networking	4th/5th	Behrouz A. Forouzan	Tata McGraw-Hill	
3	Computer Networks		A S Tanenbaum	Pearson Education	

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Data Communications and Networking		Behrouz A. Forouzan		
2	Internetworking with TCP/IP		Douglas Comer		
3	Computer Networks: A Top-Down Approach		Behrouz A. Forouzan, Firouz Mosharraf	Tata McGraw-Hill Education	

Useful Link /Web Resources:

1. https://www.youtube.com/c/PracticalNetworking
2. **https://www.geeksforgeeks.org/socket-programming-cc/**

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(Programme- Computer Science& Engineering w.e.f.A.Y.2025-2026

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Course Title:-Computer Architecture & Microprocessor Systems	
Course Code:- CSE24PCC213	**Semester:-**III
Teaching Scheme: L-T-P:2-0-0	**Credits:**2
Evaluation Scheme: ISE-I (15 Marks), ISE-II (15 Marks)	**ESE Marks:**50
Pre-requisite-	CNF24FE114- Computer and Network Fundamentals

Course Objectives:

1	To understand the Architecture and Basic Programming model of 8085
2	To classify the instruction formats and various addressing modes of 8086 microprocessor
3	To make the students aware of overall design and architecture of computer and its organization
4	To understand the parallelism both in terms of single and multiple bus processors

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	**Describe**theArchitectureof8085microprocessor	Understand
2	**Classify** the 8086AssemblyInstructionssetand use in Assembly language Programs	Understand
3	**Apply** the different algorithms to perform arithmetic operations	Apply
4	**Articulate** the design issues in the development of processor and pipelining for high performance Processor design	Understand

Curriculum Details

Course Contents	Duration
UNIT-I8085MicroprocessorArchitecture&ProgrammingTechniques • The 8085 Architecture, • Opcodes fetch, • Memory read and writes machine cycle. • 8085 instruction groups, addressing modes. • Writing and execution assembly language program, • Stack, • Instruction related to stack execution of CALL and RET, • The 8085 interrupt, • RST instructions, • vectored interrupts, • RIM and SIM instructions	**6Hrs**
UNIT-II 8086Microprocessor&AssemblyLanguageProgramming • The 8086 Processor Architecture, • Register organization, • Physical memory organization, • Minimum and Maximum mode system and timings. • 8086 Instruction Set and Assembler Directives • Machine language instruction formats, • addressing modes, • Instructionsetof8086,	**8Hrs**

:

• Programming with an assembler, • Assembly Language example programs. • Stack structure of 8086, • Interrupts and Interrupt service routines, • Interrupt cycle of 8086.	
UNIT-III Computer Arithmetic • Arithmetic Operations, • Binary Arithmetic, • Signed Numbers • Binary Numbers, • Decimal Arithmetic Operations, • Floating Point Arithmetic, • Floating Point Number Operations: IEEE 754 Floating Point Format, • General Multiplication, • Booth Multiplication, • Array Multiplier & Division	**6Hrs**
UNIT-IV Processing Unit & Pipelining • Fundamental Concepts, • Execution of complete Instruction, • Single & Multiple bus organization, • Hardwired control & Micro programmed Control, • Basic Concepts: Role of Cache Memory, • Pipeline Performance, • Data Hazards: Operand Forwarding	**8Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	1	-	-	-	-	-	3	-	-	2	1	-
2	3	2	-	-	3	-	-	3	-	-	2	1	-
3	3	3	3	-	-	-	-	3	-	-	-	2	1
4	3	2	2	-	3	-	-	3	-	-	-	1	1
5	3	3	3	-	-	-	-	3	-	-	-	2	1

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr.No	Title	Edition	Author(s)	Publisher	Year
1	TheINTELMicroprocessors; Architecture, Programming and Interfacing	8th	BarryBBrey		
2	Microprocessors and Microcontrollers-	7th	N.Senthi Kumar, M, Saravanam&S Jeevananthan	Oxford University Press	
3	ComputerOrganization	5th	CarlHamacher, ZvonkoVranesic, Safwat Zaky	TataMcGraw-HillEducation	

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ReferenceBooks:

Sr.No	Title	Edition	Author(s)	Publisher	Year
1	Microprocessors Architecture, ProgrammingandApplication with8085	3rd	Ramesh Gaonkar	PENRAM	

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2	ComputerOrganization	5th	CarlHamacher, Zvonko Vranesic, SafwatZaky	TataMcGraw-HillEducation	2002
3	Computerorganizationand Architecture ,	9th	William Stallings	Pearson	
4	The Microcomputer Systems: the 8086.8088 Family	3rd	YuChennA. Gibson	PHILtd	

UsefulLink/WebResources:

1. https://nptel.ac.in/courses/106/104/106104220
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-823-computer-system-architecture-fall-2005/
3. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
4. https://www.electronicshub.org/8085-microprocessor/

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(Programme- Computer Science& Engineering w.e.f.A.Y.2025-2026

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Course Title: Computer Architecture & Microprocessor Systems Laboratory	
Course Code: CSE24PCC213	**Semester: III**
TeachingScheme:L-T-P:0-0-2	**Credit:1**
Evaluation Scheme: INT- 25Marks	**ESE/POE/OE Marks:- -**
Pre-requisite-	CNF24FE114- Computer and Network Fundamentals

Course Objectives:

1.	To identify and describe the basic components of a computer system
2.	To classify the instruction formats and various addressing modes of 8085 & 8086 Microprocessor.
3.	To give the hands on experience of Assembly language programming for 8085 &8086 Microprocessors
4.	To understand the parallelism both in terms of single and multiple processors

Course Outcomes (COs): After successful completion of the course, students will be able to:

C O	**Statements**	**BTL**
1	**Learn** hardware and software interaction and integration	Understand
2	**Represent** the instruction set, instruction formats	Understand
3	**Develop** simple assembly language programs using 8085 instruction set	Apply
4	**Develop** and execute variety of assembly language programs of Intel 8086 including Arithmetic and logical and string manipulation operations	Apply

List of Experiments-

Exp. No	**TitleofExperiments**	**Duration**
01	Study of number system and logic gates	2Hrs
02	WriteaprogramtoAdditionoftwohexadecimal&decimalnumbers	2Hrs
03	Writeaprogramtosubtracttwohexadecimal&decimalnumbers	2Hrs
04	Practicaldemonstrationof8085programinvolvingdatatransferand arithmeticinstructionset	2Hrs
05	Practicaldemonstrationof8085programsinvolvinglogicalandbit manipulationinstructionset	2Hrs
06	Practicaldemonstrationof8086programsinvolvingbranchinstructionand machinecontrolinstructionset	2Hrs
07	Useofassemblerdirectivesandfindsthecountandthesumofeven,odd numberfromthegivenarray	2Hrs
08	Practicaldemonstrationofbasiclogicinstruction,shiftandrotateinstruction andBCDandASCII	2Hrs
09	WriteanALPtotransferofastringinforwarddirection	2Hrs
10	PracticaldemonstrationofDosinterrupttoreadcharfromkeyboardand displayonthescreen	2Hrs

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CourseArticulationMatrix: MappingofCourseOutcomes(Cos)withProgramOutcomes(PO's)

PO's CO's	1	2	3	4	5	6	7	8	9	10	11	PS O1	PS O2
1	1	3	-	-	-	-	-	-	-	-	-	1	-
2	2	3	1	-	1	-	-	-	-	-	-	1	-
3	3	3	-	2	-	-	-	-	-	-	-	1	-
4	3	3	2	-	1	-	-	-	-	-	-	2	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources: --

Text Books:

Sr.No	Title	Edition	Author(s)	Publisher	Year
1	The INTEL Microprocessors; Architecture, Programming and Interfacing	8th Edition	BarryBBrey		
2	Microprocessors and Microcontrollers-	7th	N.Senthi Kumar, M,Saravanam& SJeevananthan	Oxford University Press	
3	ComputerOrganization	5th	Carl Hamacher, ZvonkoVranesic, SafwatZaky	TataMcGraw-HillEducation	

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Sr.No	Title	Edition	Author(s)	Publisher	Year
1	MicroprocessorsArchitecture, Programming and Application with 8085	3rd	Ramesh Gaonkar	PENRAM	
2	ComputerOrganization	5th	CarlHamacher, Zvonko Vranesic, SafwatZaky	TataMcGraw-HillEducation	2002
3	Computerorganizationand Architecture ,	9th	William Stallings	Pearson	
4	The Microcomputer Systems: the 8086.8088 Family	3rd	YuChennA. Gibson	PHILtd	

UsefulLink/WebResources:

1. https://gnusim8085.github.io/
2. https://emu8086-microprocessor-emulator.en.softonic.com/
3. https://vlab.co.in/→Searchfor***MicroprocessorVirtualLabs***
4. https://www.geeksforgeeks.org/introduction-of-8085-microprocessor/

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(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

Course Title :- Fundamentals of Software Testing	
Course Code:- CSE24MDM214	**Semester:- III**
Teaching Scheme L-T-P : 2-0-0	**Credits : 2**
Evaluation Scheme: ISE-I (10 Marks), ISE-II (10 Marks)	**ESE Marks: - 50 marks**
Prerequisite	PSCL24FE113- Problem Solving with C-Language

Course Objectives:

1	To expose the students to basic concepts and principles of software testing.
2	To make the students aware of the importance of testing strategies.
3	To expose the students to Software test plans and level.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand systematic software testing importance.	Understand
2	Understand the software testing life cycle.	Understand
3	Describe the process of testing.	Understand
4	Understand the testing standards.	Understand

Curriculum Details

Course Contents	Duration
Unit-I Introduction to Software Engineering and Software Testing • Software Engineering and its importance, • Software Process and Project, • Component Software Processes, • SDLC, • Software Development Process Modules (Waterfall, Prototype, Spiral, V-model, RAD, Iterative), • Project Management Process. • Agile Development- XP, other Agile Process Models. • **Testing**:-Testing Process, • Selection of Good Test Cases, and Measurement of Testing. • Incremental Testing Approach, • Basic Terminology Related to Software Testing. • Testing Life Cycle (STLC), • Principles of Testing, • Limitations of Testing.	**10 Hrs**

Unit-II Software Verification and Validation • Differences between Verification and Validation, • Differences between QA And QC, • V&V Limitations, • Categorizing V&V Techniques, • Role of V&V in SDLC-Tabular Form (IEEE std. 1012), • Software V&V Planning (SVVP), • Software Technical Reviews (STRS).	**6Hrs**
Unit-III Types of Testing and Levels of Testing • Functional and Non-Functional Testing. • Introduction, Unit, Integration, System, and Acceptance Testing Relationship, Integration Testing, • Classification of Integration Testing, • Decomposition-Based Integration, • Call Graph-Based Integration, • Path-Based Integration with its Pros and Cons.	**7 Hrs**
Unit-IV Specialized Testing Types, Software Testing Standards • Regression Testing, • Smoke Testing, • Sanity Testing, • Exploratory Testing and Ad-hoc Testing in Agile Development, • Introduction to Agile Development and Agile Testing Quadrants. • Introduction to Software Testing Standards, • Key Software Testing Standards, • Industry-Specific Testing Standards	**7 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	1	2	-	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	-	-	-	-	-	-	-	1	-
3	2	2	-	-	1	-	-	-	-	-	-	-	-
4	1	-	-	-	-	1	-	-	-	1	-	-	1

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	"Software Engineering - A precise approach"		Panjkaj Jalote	Wiley India	2010
2	"Software Testing - A Self Teaching Introduction"		Rajiv Chopra	Mercury Learning and Information	2018
3	"Software Engineering Principles and Practices"		Rohit Khurana	Vikas Publication	2010

4	"Software Testing and Quality Assurance Theory and Practices"		Kshirasagar Naik, Priyadarshi Tripathi	Wiley,	2008

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	"Software Engineering Principles and Practice"		Hansvan Vliet,	Willey-India	2006
2	"Software Engineering"		P Fleeger,	Pearson Education, India	2009
3	"Software Testing",		Yogesh Singh,	Cambridge	2012

Useful Link /Web Resources:

1. https://www.geeksforgeeks.org/software-testing-basics/
2. https://www.geeksforgeeks.org/software-testing-tutorial/
3. https://www.coursera.org/learn/foundations-of-software-testing-and-validation

D.Y.PATIL TECHNICAL CAMPUS

FACULTY OF ENGINEERING & FACULTY OF MANAGEMENT,

(An Autonomous Institute)

Department of Computer Science & Engineering

S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Title :- Privacy & Security in Online Social Media	
Course Code:- CSE24OE215	**Semester:- III**
Teaching Scheme L-T-P : 3-1-0	**Credits : 4**
Evaluation Scheme: ISE-I (15 Marks), ISE-II (10 Marks),), INT (25 Marks)	**ESE Marks: 50 marks**
Prerequisite-	CNF24FE114-Computer and Network Fundamentals, PC24FE126- Professional Communication

Course Objectives:

1	To learn the basic concepts & functions of social media.
2	To study trust management-related social media.
3	To study privacy & ethics related issues in social media.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Explain social media implications in real life.	Understand
2	Describe trust management on social media.	Understand
3	Explain privacy concerns on social media.	Understand
4	Describe security issues related to social media.	Understand

Curriculum Details

Course Contents	Duration
UNIT 1:Introduction • Introduction to Social Networks, • From offline to Online Communities, • Online Social Networks, • Evolution of Online Social Networks, • Analysis and Properties, • Security Issues in Online Social Networks, • Trust Management in Online Social Networks, • Controlled Information Sharing in Online Social Networks, • Identity Management in Online Social Networks, • Data collection from social networks, • Challenges, opportunities, and pitfalls in online social networks, • APIs	**07 Hrs**

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UNIT 2:Trust Management in Online Social Networks • Trust and Policies, • Trust and Reputation Systems, • Trust in Online Social, • Trust Properties, • Trust Components, • Social Trust and Social Capital, • Trust Evaluation Models, • Trust, credibility, and reputations in social systems; • Online social media and Policing, • Information privacy disclosure, revelation, and its effects in OSM and online social networks; • Phishing in OSM & Identifying fraudulent entities in online social networks	**07 Hrs**
UNIT 3:Controlled Information Sharing in Online Social Networks • Access Control Models, • Access Control in Online Social Networks, • Relationship-Based Access Control, • Privacy Settings in Commercial Online Social Networks, • Existing Access Control Approaches	**07Hrs**
UNIT 4:Identity Management in Online Social Networks • Identity Management, • Digital Identity, • Identity Management Models: From Identity 1.0 to Identity 2.0, • Identity Management in Online Social Networks, • Identity as Self-Presentation, • Identity thefts, • Open Security Issues in Online Social Networks	**07 Hrs**
UNIT 5:Ethics • Ethics bias on social media – emotional contagion, studies of concern, informed consent, • Biases in social data, inference from biased data, • Ethics in social media research: Studies of concern, • Ethics in social media research: Solutions, • Bias in social media research	**07 Hrs**
UNIT 6:Case Study • Privacy and security issues associated with various social media such as Facebook, Instagram, Twitter, LinkedIn etc.	**07 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

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POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	3	-	-	-	-	-	-	-	-	2	2
2	3	3	3	-	-	-	-	-	-	-	-	2	2
3	3	3	3	-	-	-	-	-	-	-	-	2	2
4	3	3	3	-	-	-	-	-	-	-	-	2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Security and Privacy in Social Networks	--	YanivAltshuler, Yuval Elovici, Armin B. Cremers, NadavAharony, Alex Pentland	Springer	2013
2	Security and Privacy in Mobile Social Networks	--	Xiaohui Liang, Rongxing Lu, Xiaodong Lin, Xuemin Shen	Springer	2013

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Security and Privacy Preserving in Social Networks	--	Richard Chbeir, Bechara Al Bouna	Springer	2013

Useful Link /Web Resources:

1DELNET- http://www.delnet.in
2NDL-http://ndl.iitkgp.ac.in
3 N-LIST- http://www.nlist.inflib.ac.in

:

List of Tutorials-

Exp. No	Title of Experiments	Duration
01	To study social network analysis.	01 Hr
02	To study data collection from social media.	01 Hr
03	To study text analysis of social media data.	01 Hr
04	To study cybercrimes on social media.	01 Hr
05	To study fake news on social media.	01 Hr
06	To study privacy settings and privacy policies on social media.	01 Hr
07	To study ethics and bias on social media.	01 Hr
08	Case study twitter.	01 Hr
09	Case study reddit.	01 Hr
10	Case study Instagram.	01 Hr

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S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

Course Title :- Software Project Management	
Course Code:- CSE24OE215	**Semester:- III**
Teaching Scheme L-T-P : 3-1-0	**Credits : 4**
Evaluation Scheme: ISE-I (15 Marks), ISE-II (10 Marks), INT (25 Marks)	**ESE Marks: 50 Marks**
Prerequisite-	Basic knowledge of computer

Course Objectives:

1	To provide basic understanding of project management principles and practices.
2	To learn the basics of Project Planning and Scheduling.
3	To understand the importance of Time, Cost and Quality attributes in project management.
4	To learn the agile development practices and an agile approach to software development.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Identify project characteristics and various stages of project management.	Understand
2	Apply the concept of project planning and scheduling to meet the goals of project management.	Apply
3	Understand the importance of scope, time and cost attributes in project management.	Understand
4	Use and apply the fundamental concepts of agile methodology and agile development practices in project management.	Apply

Curriculum Details

Course Contents	Duration
Unit-I Introduction to Software Project Management • Introduction-1 (Introduction about Software Project Management, Jobs, Projects, Exploration), • Introduction-II (Introduction of Software projects, • Types of Software Project, Project Management Activities), • Introduction-III (Introduction of Software products & services, Project Management Activities), • Project Management Standards, • Life Cycle Models I (Waterfall Model, V Model, Evolutionary Model, Prototyping Model).	**8Hrs**

Unit-II Selection of a Project Approach • Life Cycle Models-II (Waterfall Model, V Model, Evolutionary Model, Prototyping Model), • Life Cycle Models III (Reflection on Waterfall based Model, Incremental, RAD, Evolutionary), • Life Cycle Models IV (Evolutionary Model, Agile Model), • Life Cycle Models - V (Agile Model), • Life Cycle Models-VI (Sprint, Scrum framework).	**8Hrs**
Unit-III Project Estimation Techniques • Project Evaluation and Programme Management (Business case for Project, Project Portfolio Management, Project Management), • Project Estimation Techniques (Introduction, Project planning, Basics of Project Estimation)	**7Hrs**
Unit-IV Project Planning and Project Scheduling • Project Estimation Techniques (Parametric Model, COCOMO 81, COCOMO II), • Project Scheduling, • Project Scheduling Using PERT/CPM, • Computation of Project Characteristics Using PERT/CPM, • Computation of Project Characteristics Using PERT/CPM: Illustration..	**8Hrs**
Unit-V Project Organization and Team Structures, Risk Management, • PERT, • Project Crashing, • Team Management, • Organization and Team Structure, • Risk Management, • Introduction to Software Quality, • Risk Management, • Resource Allocation, • Project Monitoring and Control	**7Hrs**

Unit-VI Project Monitoring and Control, Software Configuration Management, Software Quality Management • Project Monitoring and Control, • Contract Management, • Project Close Out, • Software Quality Management (Evolution of Quality Systems), • ISO 9000 (Structure & Certification), • ISO 900(Requirements) 1, • SEI CMM	**7Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	2	-	-	-	-	-	-	1	-	-	2	-	-
2	2	1	-	-	-	-	-	-	-	-	-	1	-
3	2	2	-	-	-	-	-	-	-	-	-	-	-
4	2	1	1	-	-	-	-	1	-	-	1	1	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution:1 No Contribution—

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Project Management Core Text Book	First Indian Edition	Samueal Mantel Jr., Jack Meredith, Sutton, M. R. Gopalan, Scott Shafer	Wiley India Pvt Ltd	15 September 2006
2	Agile & Iterative Development-A managers Guide		Craig Larman	Pearson Education	27 August 2003

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Information Technology Project Management,	7e	Kathy Schwalbe	Cengage Learning Australia	9 September 2013
2	Software Project Management	6Edition	Bob Huges, Mike Cotterell, Rajib Mall	McGraw Hill Education.	Nov 23, 2021

Useful Link /Web Resources:

1. NPTEL Course - https://nptel.ac.in/courses/106105218
2. ASANA-Manage your team's work, projects, & tasks online
3. Slack-https://slack.com
4. JIRA-Jira suite of products | How teams do great work - together (atlassian.com)

Tutorial List

Sr No	Tutorial	Duarion
1	*Comparison of Different SDLC Models* Compare **Waterfall, V-Model, Prototyping, and Evolutionary Models** using case studies.	1 Hr
2	***Agile vs. Traditional Models*** **Compare** Agile (Scrum, Sprint) vs. Waterfall **in real-world scenarios.**	1 Hr
3	***Incremental & RAD Model Implementation*** **Case study on** RAD (Rapid Application Development) **for fast-paced projects.**	1 Hr
4	***Business Case & Portfolio Management*** **Develop a** business case **for a sample software project.**	1 Hr
5	***Estimation Techniques (Function Points, LOC)*** **Calculate** effort, cost, duration **using basic estimation methods.**	1 Hr
6	**PERT/CPM Scheduling** Create a PERT chart and identify the critical path for a given project.	1 Hr
7	**Risk Identification & Mitigation Strategies** Perform risk assessment for a software project using FMEA (Failure Mode Effect Analysis).	1 Hr
8	**ISO 9000 & CMMI Compliance** Analyze how ISO 9000 & CMMI improve software quality. Mini-case study on project closeout & audit.	1 Hr

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S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

Course Title :- Community Engagement Project	
Course Code:- CSE24CPE216P	**Semester:- III**
Teaching Scheme L-T-P : 0-0-4	**Credits : 2**
Evaluation Scheme: INT- 50 Marks	**ESE Marks: -**
Prerequisite-	**-**

Course Objectives:

1	To promote awareness and utilization of government e-services among nearby communities.
2	To familiarize students to use computer science knowledge to solve real world problems of society.
3	To develop teamwork, communication, and presentation skills through group projects.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand knowledge of various e-services provided by the Government of India to address common people issues.	Understand
2	Work effectively in groups while collecting data, preparing presentations and videos on the identified problem.	Analyze
3	Apply classroom knowledge to identify and solve the problems of people in nearby communities.	Analyze
4	Advocate for the adoption of government e-services and provide solutions to the real- world problem of the nearby people.	Analyze

Curriculum Details

Course Contents	Duration
Week 1-2: Introduction to Community engagement projects and common people issues. • Understanding the concept of community engagement projects. • Identifying common problems in rural areas (e.g. healthcare, education, infrastructure) • Case studies and discussions on successful community service initiatives.	**8 Hrs**
Week 3-4: Government E-Services Overview and identifying real world problems • Introduction to government e-services in India and overview of digital platforms and portals (e.g., Digi locker, e-Gram Swaraj) • Identifying and understanding the real-world issues (in nearby society) and performing brainstorming sessions to provide computer science knowledge to solve the same. • Students can arrange visits to nearby places to do surveys by forming a group of minimum 4 to maximum 5 students.	**8 Hrs**

Week 5-8: Project development and Preparation • Group of students can use multiple online sources to solve the identified problems. • Planning and organizing group tasks and responsibilities. • Time to time discussion of the progress with the subject teacher.	**16 Hrs**
Week 9-10: Project Presentation and reviews. • Researching chosen rural issue(s) and relevant government e-services. • Creating presentations and scripts for the video demonstration. • Reviewing and refining project materials based on feedback by people and teachers.	**8 Hrs**
Week 11-12: Demonstration of student work to the beneficiaries and video preparation. • Presentations and demonstrations to the beneficiaries on chosen issues through field visit. • Students must create short videos of their work which demonstrate the whole project activities and hit it to the department • Peer evaluation and feedback session by beneficiaries and teachers.	**8 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	-	-	-	-	-	-	-	-	-	3	-	1	-
2	-	-	-	-	-	-	-	-	3	3	-	1	-
3	3	3	3	3	3	2	-	-	3	-	3	3	3
4	-	-	-	-	-	-	-	-	-	-	-	2	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Useful Link /Web Resources:

1. https://csc.gov.in/digitalIndia
2. https://www.studyiq.com/articles/digital-india-mission/

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Department of Computer Science and Engineering

S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

Course Title :- Intellectual Property Rights	
Course Code:- CSE24HSSM217	**Semester:- III**
Teaching Scheme L-T-P : 2-0-0	**Credits : 2**
Evaluation Scheme: ISE1(15),MSE(20),ISE2(15)	**ESE Marks: -**
Prerequisite-	**-**

Course Objectives:

1	Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
2	Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development
3	Impart knowledge on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Define the importance of Intellectual Property Rights.	Remember
2	Explain the Patents, Searching, filling and drafting of Patents.	Understand
3	Understand the copyright & GI.	Understand
4	Analyze the Trade Mark & Trade Secret.	Analyze

Curriculum Details

Course Contents	Duration
Unit 1: Introduction ● Intellectual Property Law Basics, ● Types of Intellectual Property, ● Agencies Responsible for Intellectual Property Registration, ● International Organizations, ● Agencies, and Treaties, ● The Increasing Importance of Intellectual Property Rights.	**4 Hrs**
Unit 2: Patents ● Patents- Patentability Criteria, ● Types of Patents-Process, Product & Utility Models, ● Software Patenting and protection, ● Patent infringement- Case studies- Apple Vs Samsung, Enfish LLC Vs Microsoft, ● Overview of Patent search-Types of Searching, Public & Private Searching Databases, ● Basics of Patent Filing & Drafting, ● Indian Patents Law	**6 Hrs**

Unit 3 :Copyrights ● Fundamental of copyright, ● originality of material, ● rights of reproduction, ● rights to perform the work publicly, ● copyright ownership issues, ● notice of copyright	**4 Hrs**
Unit 4: Trade Marks ● Introduction, Purpose and Function of Trademarks , ● Types of Marks: Trademarks, Service Marks, ● Certification Marks, and Collective Marks , ● Acquisition of Trademark Trademark Selection and Searching - Selecting and Evaluating a Mark, ● The Trademark Registration Process - Preparing the Application, ● Drawing of Mark, ● Filing the Application, ● Docketing Critical Dates, and Initial Role of the U.S. Patent and Trademark Office ● The Examination Process, ● Post examination Procedure , ● Registration	**6 Hrs**
Unit 5: Trade Secrets ● Determination of trade secret status, liability for misappropriation of trade secrets, protection for submission ● Protection of Industrial Designs & Integrated Circuits: Industrial Designs – Scope, protection, filing, infringement; ● Integrated Circuits & Layout design, Semiconductors, Unfair competition, Designs Act.	**6 Hrs**
Unit 6: New development of Intellectual Property: ● Emerging trends in trade mark; ● copyrights, ● patent, ● International overview on intellectual property.	**4 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	-	-	-	-	-	-	-	2	-	-	-	-	-
2	-	-	3	-	-	-	-	2	-	-	-	-	2
3	-	-	3	-	-	-	-	2	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution:1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Intellectual property -the law of trademarks , copyrights, patents and trade secrets	fourth edition	Deborah E. Bouchoux		
2	Principles of Intellectual Property		N.S. Gopalakrishnan & T.G. Agitha,	Eastern Book Company	

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Intellectual Property Rights: Basic Concepts		M. M. S. Karki	Atlantic Publishers	
2	Intellectual Property Rights		Neeraj Pandey & Khushdeep Dharni	Phi Learning Pvt. Ltd	

Useful Link /Web Resources:

1. https://mrcet.com/downloads/digital_notes/CSE/II%20Year/INTELLECTUAL%20PROPERTY%20RIGHTS-NOTES.pdf
2.https://mitmecsept.files.wordpress.com/2018/10/deborah_ebouchoux_intellectual_property_the_lbookzz-org.pdf
3. https://www.wipo.int/about-ip/en/
4. https://www.wto.org/english/tratop_e/trips_e/intel1_e.htm

D.Y.PATIL TECHNICALCAMP
FACULTYOFENGINEERING& FACULTYOFMANAGE
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S. Y. B. Tech. Curriculum
(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

Course Title :- Applications of Data Structures	
Course Code:- CSE24VEC218P	**Semester:- III**
Teaching Scheme L-T-P : 0-0-4	**Credits : 2**
Evaluation Scheme: INT-25 Marks	**POE: 25 Marks**
Prerequisite-	PSCL24FE113- Problem Solving with C-Language, DS24FE124- Data Structure

Course Objectives:

1	To demonstrate familiarity with major algorithms and data structures and analyze performance of algorithms.
2	To make a choice of appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.
3	To write data structure programs using C programming language

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Implement various basic data structures and its operations.	Understand
2	Implement various sorting and searching algorithms.	Applying
3	Implement various tree operations.	Applying
4	Implement various graph algorithms.	Applying

List of Experiments-

Exp. No	Title of Experiments	Duration
01	Implement a **stack** (LIFO – Last In First Out) using a fixed-size array. It supports basic operations like **push**, **pop**, **peek**, and checks for overflow/underflow.	4 hrs
02	Implement a **singly linked list** with operations to insert nodes at the beginning, end, or a specific position, delete nodes, and display the list.	4 hrs
03	Implement a dynamic stack using a **linked list** where each node stores data and a pointer to the next node. Push and pop operations are performed at the head.	4 hrs
04	Implement a **queue** (FIFO – First In First Out) using arrays with operations like **enqueue**, **dequeue**, and checking front/rear elements, full or empty status.	4 hrs
05	A dynamic implementation of a queue using a **linked list**, supporting **enqueue** at the rear and **dequeue** from the front.	4 hrs
06	Implement a basic binary tree structure and supports traversal operations: • Inorder (LNR) • Preorder (NLR) • Postorder (LRN) It shows the structure and hierarchy of tree-based data.	4 hrs

07	Implement a Binary Search Tree, where each node follows the rule: left < root < right. Supports insertion, searching, and deletion of nodes.	4 hrs
08	Implement a basic version of a **B+ Tree**, which is a type of balanced search tree	4 hrs
09	Demonstrate two searching techniques: ● Linear Search: Traverses the array sequentially. ● Binary Search: Applies divide-and-conquer (sorted arrays only). Displays the number of comparisons made in each method.	4 hrs
10	Implement two simple sorting algorithms: ● Bubble Sort: Repeatedly swaps adjacent elements if they are in the wrong order. ● Selection Sort: Selects the smallest/largest element and places it in the correct position.	4 hrs
11	Implement two efficient divide-and-conquer sorting algorithms: ● Quick Sort: Uses a pivot to partition the array and recursively sorts the partitions. ● Merge Sort: Divides the array into halves, sorts each half, and merges them.	4 hrs
12	Implement a graph using a sparse matrix format, which is a memory-efficient way to store graphs with many vertices but few edges.	4 hrs

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs /COs	1	2	3	4	5	6	7	8	9	10	11	POS1	POS2
1	2	2	-	-	-	-	-	-	-	-	-	1	-
2	2	2	2	2	-	-	-	-	-	-	-	1	-
3	2	2	-	2	-	-	-	-	-	-	-	1	-
4	2	3	3	2	-	-	-	-	-	-	-	1	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution: –

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Schaum's Outlines Data Structures		Seymour Lipschutz	MGH	
2	Data structures, Algorithms and Applications in C++	2nd	SartajSahni	Universities Press	
3	Data structures and Algorithms in C++	4th	Adam Drozdek	Cengage learning	

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Data Structures using C and C++		YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum	Pearson Education	

Online References

- http://onlinecourses.swayam2.ac.in/cec19_cs04/preview
- https://www.geeksforgeeks.org/dsa-tutorial-learn-data-structures-and-algorithms/

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(An Autonomous Institute)

(Approved by AICTE, New Delhi , Recognized by Government of Maharashtra &Affiliated to Shivaji University, Kolhapur)

(Accredited by NAAC'A' Gradewith3.25 CGP A in First Cycle)

SCHEME OF INSTRUCTION & SYLLABI

Programme: - Computer Science & Engineering

Semester–IV (w.e.f.A.Y.2025-26)

Sr No	Course Category	Course Code	Course Title	L	T	P	Course Credits	EXAM SCHEME					
								ISE	MSE	ESE	INT	OE/POE	TOTAL
1	PCC	CSE24PCC221	Automata Theory	3	-	-	3	20	30	50	-	-	100
2		CSE24PCC222	Operating System	3	-	-	3	20	30	50	-	-	100
		CSE24PCC222P	Operating System Lab	-	-	2	1	-	-	-	20	-	20
3		CSE24PCC223	Software Engineering	3	-	-	3	-	30	50	-	-	80
4	MDM-2	CSE24MDM224	Automation and Manual Testing	2	-	-	2	20	-	30	-	-	50
5	OE-2	CSE24OE225	Computer Graphics & Multimedia IoT	2	-	-	2	20	-	30	-	-	50
6	VEC	CSE24VEC226	Environmental Study	2	-	-	2	20	-		30	-	50
7	HSSM	CSE24HSSM227	Technologies used for Project management and Start-ups	1	-	-	1	25	-	-	-	-	25
		CSE24HSSM227P	Technologies used for Project management and Start-ups	-	-	2	1	-	-	-	25	-	25
8	VSEC	CSE24VSEC228	Java Programming	1	-	-	1	-	-	-	25	-	25
		CSE24VSEC228P	Java Programming	-	-	2	1	-	-	-	-	50	50
9	AEC	CSE24AEC229P	Mini Project using S/W Engg Lifecycle	-	-	4	2	-	-	-	50	50	100
Non Credit Mandatory Course													
10	MC	CSE24MC2210	Finishing School Training IV	3	-	-	NC	-	-	-	50	-	Grade
11	CCA	CSE24CCA2211	Liberal Learning	1	-	-	NC	-	-	-	50	-	Grade
Total				**17**	**0**	**10**	**22**	**125**	**90**	**210**	**150**	**100**	**675**
12	HC	CSE24HC2212	Fundamentals of Cyber security	3	-	-	3	20	30	50	-	-	100
		CSE24HC2212P	Fundamentals of Cyber security Lab	-	2	-	1	-	-	-	25	-	25
	DM	CSE24DM2212	Introduction to Data Science	3	-	-	3	20	30	50	-	-	100
		CSE24DM2212P	Introduction to Data Science Lab	-	2	-	1	-	-	-	25	-	25

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S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Title :- Automata Theory	
Course Code:- CSE24PCC221	**Semester:- IV**
Teaching Scheme L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme: ISE-I(10 Marks), MSE (30 Marks), ISE-II(10 Marks)	**ESE Marks: 50 marks**
Prerequisite-	CSE24PCC211-Discrete Mathematical Structures

Course Objectives:

1	To introduce students to the mathematical foundations of computation, the theory of formal languages and grammars.
2	To strengthen the student's ability to understand and conduct mathematical proofs for Computations.
3	To make the students understand the use of automata theory in Compliers & System Programming.
4	To analyze and design finite automata, pushdown automata, grammars & Turing machines.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Describe basic concepts of Regular Language and Regular Expressions.	Understand
2	Demonstrate to select appropriate abstract machine to recognize a given formal language.	Apply
3	Demonstrate to generate complex languages by applying Union, Intersection, Complement, Concatenation and Kleene * operations on simple languages.	Apply
4	Apply parsing concepts for syntax analysis.	Apply
5	Demonstrate to be familiar with thinking analytically and intuitively for problem solving situations in related areas of theory in computer science.	Apply

Curriculum Details

Course Contents	Duration
Unit-I Regular Languages and Finite Automata • Proofs, • Recursive Definitions, • Regular expressions and regular languages, • Finite Automata, • Unions, intersection & complements of regular languages, replications of FA	**08 Hrs**
Unit-II Nondeterminism and Kleene's Theorem • Nondeterministic finite automata, • NFA with null transition, • Equivalence of FA's, • Kleene's Theorem (Part I & Part II), • Minimal Finite Automata	**07 Hrs**

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Unit-III Context free Grammars • Definition, • Union, • Concatenation and Kleene *'s of CFLs, • Derivation trees and ambiguity, • Simplified forms and normal forms	**06 Hrs**
Unit-IV Parsing and Pushdown Automata • Definition of Pushdown Automata, • Deterministic PDA, • Equivalence of CFG's& PDA's, • Top down parsing, bottom up parsing.	**07 Hrs**
Unit-V Context free languages • CFL's and non CFL's, • Pumping Lemma, • Intersections and complements of CFLs	**06 Hrs**
Unit-VI Turing Machines • Definition, • TM as language acceptors, • Combining Turing Machines, • Computing partial function with a TM, • Multi-tape TMs, and Universal TM	**07 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	3	3	-	-	-	-	-	-	-	2	2
2	3	3	3	3	-	-	-	-	-	-	-	2	2
3	3	3	3	3	-	-	-	-	-	-	-	2	2
4	3	3	3	3	-	-	-	-	-	-	-	2	2
5	3	3	3	3	-	-	-	-	-	-	-	2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

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Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Introduction to Languages & the Theory of Computations	--	John C. Martin	Tata MGH Edition	--
2	Discrete Mathematical Structures with applications to Computer Science	--	J. P. Trembley & R. Manohar	MGH	--

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Introduction to Automata Theory, Languages and computation	--	John E. Hopcraft, Raje Motwani, Jeffrey D. Ullman	Pearson Edition	--
2	Introduction to theory of Computations	--	Michael Sipser	Thomson Books/Cole	--

Useful Link /Web Resources:

1 DELNET- http://www.delnet.in

2 NDL-http://ndl.iitkgp.ac.in

3 N-LIST- http://www.nlist.inflib.ac.in

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Course Title :- Operating System	
Course Code:- CSE24PCC222	**Semester:- IV**
Teaching Scheme L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme: ISE-I (20 Marks), MSE (30 Marks), ISE-II (20 Marks)	**ESE Marks: 50 marks**
Prerequisite-	CNF24FE114-Computer and Network Fundamentals, PSCL24FE113-Problem Solving with C-Language, CSE24PCC213-Computer Architecture and Microprocessor Systems

Course Objectives:

1	To learn the basic concepts of operating system and their services and operations.
2	To study various functions of the operating system and their usage.
3	To understand process management, memory management and I/O device management.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Illustrate the structure, functions and services of an operating system.	Understand
2	Describe the methods of process management, process synchronization and deadlocks.	Understand
3	Explain the various memory management techniques in execution of programs.	Understand
4	Analyse the scheduling, file system and I/O management techniques.	Analyze

Curriculum Details

Course Contents	Duration
Unit-I Introduction • Introduction to operating system • Computer-System Organization, Computer-System Architecture • Operating System Structure, Operating System Operations • Operating System Services • Types of Operating System • Open-Source Operating System • Virtual Machines, Operating-System Generation	**07 Hrs**

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Unit-II Processes, Threads & Synchronization • System Calls, Types of System Calls • Programs, Process concepts: Process, Process State, PCB, Context Switching • Threads • Process Synchronization • Race condition, The Critical Section Problem, Synchronization Hardware • Mutex Lock, Semaphores • Classic Problems of Synchronization • Monitors	**08 Hrs**
Unit-III CPU Scheduling • Basic concepts • Types of schedulers • Preemptive and Non-preemptive scheduling policies • Scheduling Criteria • Scheduling Algorithms • Thread Scheduling • Inter process Communication	**08 Hrs**
Unit-IV Deadlocks • What is Deadlock • Necessary Conditions • Resource Allocation Graph • Methods for Handling Deadlocks: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	**07 Hrs**
Unit-V Memory-Management • Basic hardware • Swapping • Contiguous and Non Contiguous Memory Allocation • Paging, Structure of the Page Table • Segmentation, Demand Paging • Page Replacement, Thrashing	**07 Hrs**

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Unit-VI File & I/O Systems • File Concepts, Access Methods • Directory and Disk Structure, File Sharing • File-System Structure • Allocation Methods • Overview of Mass-Storage Structure, Disk Structure • Optical Disk, SSD, I/O Hardware • Transforming I/O Requests to Hardware Operations	**08 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	3	-	-	-	-	-	-	-	-	2	2
2	2	2	2	-	-	-	-	-	-	-	-	2	2
3	2	2	2	-	-	-	-	-	-	-	-	2	2
4	2	2	2	-	-	-	-	-	-	-	-	2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Operating System Concepts	Ninth Edition	Abraham Silberschatz, Peter B. Galvin &Grege Gagne	Wiley	--
2	Operating Systems –A Concept Based approach	3rd Edition	Dhananjay M Dhamdhere	TMGH	--

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Operating System: Concepts and Design	--	Milan Milenkovic	TMGH	--

Useful Link /Web Resources:

1DELNET- http://www.delnet.in
2NDL-http://ndl.iitkgp.ac.in
3 N-LIST- http://www.nlist.inflib.ac.in

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Course Title: Operating System Laboratory	
Course Code : CSE24PCC222P	**Semester: IV**
Teaching Scheme: L-T-P: 0-0-2	**Credit : 1**
Evaluation Scheme: INT: 25 Marks	**ESE/POE/OE Marks: -**
Prerequisite-	CNF24FE114-Computer and Network Fundamentals, PSCL24FE113-Problem Solving with C-Language, CSE24PCC213-Computer Architecture and Microprocessor Systems

Course Objectives:

1.	To learn the basic concepts of operating system and their services and operations.
2.	To study various functions of the operating system and their usage.
3.	To understand process management, memory management and I/O device management.
4.	To study Linux operating system and their basic commands.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Demonstrate preparation and setup operating system.	Understand
2	Describe the Linux commands and their usage.	Understand
3	Analyse the process scheduling algorithms.	Analyze
4	Explain deadlock and prevention techniques.	Understand

List of Experiments-

Exp. No	Title of Experiments	Duration

01	To Study types of OS.
	• Installation of Operating Systems
	  ○ Windows
	  ○ Linux
		02

02	Installation of Multi-Operating Systems • Installation & configuration of Virtual Box Software on Windows • Installation & configuration of Linux through Virtual Box Software	02

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03	To Study Linux OS and its commands. • Linux Commands: o ls — The most frequently used command in Linux to list directories o pwd — Print working directory command in Linux o cd — Linux command to navigate through directories o mkdir — Command used to create directories in Linux o mv — Move or rename files in Linux o cp — Similar usage as mv but for copying files in Linux o rm — Delete files or directories o touch — Create blank/empty files o ln — Create symbolic links (shortcuts) to other files o cat — Display file contents on the terminal o clear — Clear the terminal display o echo — Print any text that follows the command	02
04	To Study Linux OS and its commands. • Linux Commands: o less — Linux command to display paged outputs in the terminal o man — Access manual pages for all Linux commands o uname — Linux command to get basic information about the OS o whoami — Get the active username o tar — Command to extract and compress files in Linux o grep — Search for a string within an output o head — Return the specified number of lines from the top o tail — Return the specified number of lines from the bottom o diff — Find the difference between two files o cmp — Allows you to check if two files are identical o comm — Combines the functionality of diff and cmp o sort — Linux command to sort the content of a file while outputting o export — Export environment variables in Linux o zip — Zip files in Linux o unzip — Unzip files in Linux	02
05	To Study Linux OS and its commands. • Linux Commands: o ssh — Secure Shell command in Linux o service — Linux command to start and stop services o ps — Display active processes o kill and killall — Kill active processes by process ID or name o df — Display disk filesystem information o mount — Mount file systems in Linux o chmod — Command to change file permissions o chown — Command for granting ownership of files or folders	02

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06	To Study Linux OS and its commands. • Linux Commands: o apt, pacman, yum, rpm — Package managers depending on the distro o sudo — Command to escalate privileges in Linux o cal — View a command-line calendar o alias — Create custom shortcuts for your regularly used commands o dd — Majorly used for creating bootable USB sticks o whereis — Locate the binary, source, and manual pages for a command o whatis — Find what a command is used for o top — View active processes live with their system usage o useradd and usermod — Add new user or change existing users data o passwd — Create or update passwords for existing users	02
07	Write a C program to implement First Come First Serve process scheduling algorithm.	02
08	Write a C program to implement Shortest Job First process scheduling algorithm.	02
09	Write a C program to implement Round Robin process scheduling algorithm.	02
10	Study Dead lock prevention techniques.	02

Course Articulation Matrix: Mapping of Course Outcomes (Cos) with Program Outcomes (PO's)

PO's CO's	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	2	2	-	-	1	-	-	-	-	-	-	2	2
2	2	-	-	-	-	-	-	-	-	-	-	2	2
3	2	2	2	-	-	-	-	-	-	-	-	2	2
4	2	2	2	-	-	-	-	-	-	-	-	2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution:1 No Contribution--

Suggested Learning Resources: --

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Operating System Concepts	Ninth Edition	Abraham Silberschatz, Peter B. Galvin &Grege Gagne	Wiley	--
2	Operating Systems –A Concept Based approach	3rd Edition	Dhananjay M Dhamdhere	TMGH	--

Reference Books:

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Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Operating System: Concepts and Design	--	Milan Milenkovic	TMGH	--

Useful Link /Web Resources:
1DELNET- http://www.delnet.in
2NDL-http://ndl.iitkgp.ac.in
3N-LIST- http://www.nlist.inflib.ac.in

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Course Title :- Software Engineering	
Course Code:- CSE24PCC223	**Semester:- IV**
Teaching Scheme L-T-P: 3-0-0	**Credits : 3**
Evaluation Scheme: MSE (30)	**ESE Marks: 50 marks**
Prerequisite-	PSCL24FE113- Problem Solving with C-Language

Course Objectives:

1	To learn and understand basic concepts and principles of software engineering.
2	To make the students aware of the importance of SDLC in their project development.
3	To apply the project management and analysis principles to software project Development.
4	To apply design and testing principles to software project development

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand systematic methodologies of SDLC.	Understand
2	State SRS for their problem domain.	Remember
3	Use UML for Object Oriented Modelling.	Apply
4	Understand testing methods and importance of software maintenance.	Understand

Curriculum Details

Course Contents	Duration
Unit-I :- Introduction to Software Engineering • Software Engineering Fundamentals: Introduction to software and software engineering, • Software Processes, • Software Development Process Models-waterfall model, incremental model, spiral model, • Agile Development- XP, other Agile Process	**6 Hrs**
Unit II: Software Requirements Analysis • Introduction to Requirements Engineering. • Value of a good SRS, Requirements Process, Requirements Specifications, • Other Approaches for Analysis, • Validation. • Case study on Software requirements.	**5 Hrs**

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Unit III: Software Design • Basics of Software Design, • Data Design, • Architectural Design, • Component Level Design, • User Interface Design, • Graphical User Interface, • Object Oriented Design, • Software Design Notations, • Software Design Reviews, and Software design documentation. • Case Study for Software Design.	**6 Hrs**
Unit-IV Software Project Management and quality assurance • The management spectrum-4P's, • Project Estimation Techniques: Size estimation-LOC based estimation, • FP Based estimation, • **Project Scheduling**-basic concepts, basic principles, Defining a task set for the software project, • **Risk Management:** Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management	**6 Hrs**
Unit V: Object Modelling Using UML and OO Software Development • Basic OO Concepts, • UML, UML Diagrams, • Use Case Model, • Class Diagram, • Interaction Diagram, • Activity Diagram, • State Chart Diagram, • Postscript, • Patterns and Common Design Patterns, • OO Analysis and Design Methodology, • Interaction Modelling, • Application of analysis and Design Process.	**7 Hrs**

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Unit VI: Coding & Testing	**6 Hrs**
• Features of Software Code, • Coding Guidelines, • Coding Methodology, • Programming Practice, • Code Verification Techniques, • Coding Tools, • Code Documentation, • Software Testing Basics, • Test plan, • Test case Design, • Software Testing Strategies, • Level of Testing, • Testing Techniques, • OO Testing, Software testing Tools, • Debugging, Software Test Report. • Introduction to Software Maintenance.	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	2	2	2	-	-	-	-	-	-	-	-	-	-
2	2	2	2	-	-	1	-	-	-	-	-	1	-
3	3	2	2	-	-	1	-	-	-	-	-	-	-
4	3	2	-	-	-	-	-	-	-	-	-	-	1

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	An Integrated Approach to Software Engineering	Second Edition	Pankaj Jalote	Springer New York	1997
2	Software Engineering – A Practitioner‟s Approach	7th Edition	Roger S. Pressman,	Mc Graw Hill,	2010
3	Software Engineering Principles and Practices	2nd Edition	Rohit Khurana	Vikas Publication	2010
4	Fundamentals of Software Engineering	Third Edition	Rajib Mall,	PHI	2014

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Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Software Engineering Principles and Practice		Hans van Vliet,	Willey-India Edition.	2007
2	Software Engineering	7th Edition	Ian Sommerville	Pearson Education, India	2004

Useful Link /Web Resources:

1. www.sei.cmu.edu
2. http://www.rspa.com/spi/
3. https://onlinecourses.nptel.ac.in/noc21_cs13/course
4. https://archive.nptel.ac.in/courses/106/105/106105182/

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Course Title :- Automation and Manual Testing (MDM-II)	
Course Code:- CSE24MDM224	**Semester:- IV**
Teaching Scheme L-T-P : 2-0-0	**Credits : 2**
Evaluation Scheme: ISE-I (10 Marks), ISE-II (10 Marks)	**ESE Marks: 30 Marks**
Prerequisite	Basic Knowledge of Computer

Course Objectives:

1	To provide knowledge about manual and automation testing.
2	To reveal the different techniques of testing.
3	To describe the fundamentals of automation frameworks.
4	To make students understand testing tools.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand basics of software testing life cycle.	Understand
2	Apply different techniques of manual testing.	Apply
3	Understand the basics of automation techniques.	Understand
4	Describe different automation tools.	Understand

Curriculum Details

Course Contents	Duration
Unit-I Introduction to testing • Software Development Life Cycle, • SDLC Models, • Introduction to Testing process, • Importance of testing, • Software Testing Life Cycle, • Incremental Testing Approach, • Quality of Testing, • Differences between Manual and Automation Testing	**5 Hrs**

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Unit-II Black-Box (or Functional) , White-Box (or Structural) and Gray-Box Testing Techniques • **Introduction to Black-Box testing**, Boundary Value Analysis (BVA), Types of black box testing Equivalence Class Testing. Decision Table Based Testing, Cause-Effect Graphing Technique, Comparison on Black-Box (or Functional) Testing Techniques. • **Introduction to White-Box Testing** or Structural Testing, Static versus Dynamic White-Box Testing, Dynamic-White-Box Testing Techniques, Mutation Testing Versus Error Seeding-Comparison of Black-Box and White-Box Testing in Tabular Form, Practical Challenges in White-Box Testing, **Gray-Box Testing**, Comparison of White-Box, Black-Box, and Gray-Box Testing Approaches	**10 Hrs**
Unit-III Automated Testing & **Automation Frameworks** • Introduction of Automated Testing, • Types of Testing Tools-Static V/s Dynamic. • Problems with Manual Testing, • Benefits and limitations of Automated Testing, • Criteria for Selection of Test Tools, • Characteristics of Modern Testing Tools. • Structure of a System Test Plan, • Test Suite Structure, • Test Environment, • System Test Automation, • Stages of Automation Framework Design, scaling in Automation, • Hybrid Framework with a Combination of Data-Driven, • Keyword-Driven, Method-Driven and Behaviour-Driven.	**8 Hrs**
Unit-IV GIT and Automation Tools • GIT, • Features of GIT, • Why GIT, • GitHub, • Testing tools Selenium: Introduction, Features of Selenium, Basic terminology, • Components of Selenium, • Selenium Web Driver, • How Does Selenium Work? • Cucumber: Introduction, How cucumber works, • Advantages of Cucumber, Difference between Selenium and Cucumber.	**7 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	-	-
2	3	2	2	-	-	-	-	-	-	-	-	-	-
3	-	-	3	2	3	-	-	-	-	-	-	3	-
4	3	2	-	-	3	-	-	-	-	-	-	2	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution:1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Software Testing-A Self Teaching Introduction		Rajiv Chopra	Mercury Learning and Information,	2018
2	Software Engineering: A precise approach		Panjkaj Jalote	Wiley India,	2010
3	Software Testing and Quality Assurance Theory and Practices	First Edition	Kshirasagar Naik, Priyadarshi Tripathi	Wiley India,	2008

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Foundations of Software testing	2E	Aditya P. Mathur	Pearson	1 January 2013
2	Software Testing and Automation,	First Edition	Dr. Monika D. RokadeDr. T. Grace Shalini	TECHNICAL PUBLICATIONS	2023

Useful Link /Web Resources:

1. https://www.javatpoint.com/selenium-tutorial
2. https://www.javatpoint.com/cucumber-testing
3. https://www.javatpoint.com/git
4. https://onlinecourses.nptel.ac.in/noc20_cs19/preview

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Course Title :- Computer Graphics and Multimedia	
Course Code:- CSE24MDM225	**Semester:- IV**
Teaching Scheme L-T-P : 2-0-0	**Credits : 2**
Evaluation Scheme: ISE-I (10 Marks), ISE-II (10 Marks)	**ESE Marks: 30 Marks**
Prerequisite-	AS24FE111- Linear Algebra, PSCL24FE113-Problem Solving with C

Course Objectives:

1	To introduce the fundamental concepts of computer graphics and multimedia.
2	To provide exposure to basic graphics techniques and multimedia applications.
3	To enable students to create simple multimedia content using available tools.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand the basic concepts and applications of computer graphics and multimedia in real-world scenarios.	Understanding
2	Identify and describe the working of basic graphic elements, coordinate systems, and transformations in 2D graphics.	Understanding
3	Describe how basic drawing and animation techniques are used to create simple visual elements using graphics tools or platforms.	Understanding
4	Explain common multimedia components (text, audio, video, images) and their formats, and describe basic compression and editing techniques.	Understanding

Curriculum Details

Course Contents	Duration
Unit-I Basic of Computer Graphics • What is computer graphics? Real-life applications (games, movies, education, UI design). • Types of graphics: 2D vs 3D, static vs dynamic, raster vs vector. • Display devices overview: Monitors, LCD, OLED – how images appear on screen. • Pixels, resolution, and color models (RGB, CMYK)	**8 Hrs**
Unit-II Drawing and Animation Concepts – • Introduction to coordinates (X, Y) and grids. • Idea of transformations: Transformation (moving), Scaling (resizing), Rotation (turning) shapes • Basic animation concepts: Frames, motion, and timeline. • Introduction to drawing tools like Scratch or Pygame	**8 Hrs**

Unit-III Multimedia Concepts and Tools • Introduction to Multimedia: Definitions, Components (Text, Image, Audio, Video, Animation) • File formats: JPEG, PNG, MP3, WAV, MP4, GIF • Compression Techniques: Lossy vs. Lossless (JPEG, MPEG, Huffman coding basics) • Authoring tools: Adobe Photoshop, Audacity, OpenShot, Flash (historical context)	**7 Hrs**
Unit-IV Interactive Graphics and Animation • Basic animation principles (keyframing, tweening, frame rate) • Introduction to 3D graphics: Perspective projection basics • Event handling and GUI programming in graphics (basic input/output)	**7 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	-	-	-	-	-	-	-	-	-	-	-	1
2	3	2	-	-	-	-	-	-	-	-	-	-	-
3	2	2	-	-	2	-	-	-	-	-	-	1	-
4	3	-	-	-	-	-	-	-	-	-	-	-	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Procedural elements for Computer Graphics	-	David F. Rogers	MGH International	-
2	Mathematical elements for Computer Graphics	-	David F. Rogers, J. Alan Adams	MGH International	-
3	Computer Graphics C Version second edition	-	Donald D. Hearn, M. Pauline Baker	Pearson	-
4	Multimedia systems: Algorithms, Standards & Industry Practice	-	Parag Havaldar & Gerard Medioni,	Cengage Learning	-
5	Computer Graphics	-	Rajesh Maurya	WILEY India	-
6	Virtual & Augmented reality	-	Paul Mealy	Kindle Edition	-

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Computer Graphics	First Edition	Apurva Desai	PHI Learning	2008
2	Multimedia: Making It Work	9th Edition	Tay Vaughan	McGraw Hill	2014

Useful Link /Web Resources:

1. https://www.tutorialspoint.com/computer_graphics/index.htm
2. https://www.tpointtech.com/computer-graphics-tutorial
3. https://www.javatpoint.com/git
4. https://www.geeksforgeeks.org/introduction-to-computer-graphics/
5. https://www.w3schools.com

D.Y.PATIL TECHNICAL CAMPUS

FACULTYOFENGINEERING&
FACULTYOFMANAGEMENT,
(An Autonomous Institute)

Department of Computer Science & Engineering

S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Title :- IoT	
Course Code:- CSE24MDM225	**Semester:- IV**
Teaching Scheme L-T-P : 02-00-00	**Credits : 2**
Evaluation Scheme: ISE-I (20 Marks), ISE-II (20 Marks)	**ESE Marks: 30 marks**
Prerequisite-	CNF24FE114- Computer and Network Fundamentals, CSE24PCC213- Computer Architecture and Microprocessor Systems

Course Objectives:

1	To learn Internet of Things Technology.
2	To know the basics of RFID, Sensor technologies.
3	To aware students about wireless communication technologies and IoT applications.
4	To know the basics of IoT systems.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Describe the architecture IoTs.	Understand
2	Explain the requirements to develop IoTs devices.	Understand
3	Illustrate RFID technologies.	Understand
4	Describe IoT real-time applications using Raspberry Pi hardware.	Understand

Curriculum Details

Course Contents	Duration
Unit-I IoT & Web Technology • The Internet of Things Today, • Time for Convergence, • Towards the IoT Universe, • Internet of Things Vision, • IoT Strategic Research and Innovation Directions, • Future Internet Technologies, • Infrastructure, • Networks and Communication, • Processes, • Data Management, security, Privacy & Trust, • Device Level Energy Issues, • IoT Related Standardization, • Recommendations on Research Topics.	**07 Hrs**

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Unit-II IoT Architecture -State of the Art • Introduction, • State of the art, • Architecture Reference Model- Introduction, IoT reference Model, • IoT Reference Architecture- Introduction, • Functional View, • Information View, • Deployment and Operational View, • Other Relevant architectural views, • Smart Metering, advanced metering infrastructure, • E-health / Body Area Network, • City Automation (Smart City), • Automotive Application, • Environmental Applications, • Home Automation, • Control Applications.	**07 Hrs**
Unit-III Radio Frequency Identification Technology • RFID, • IoT objects and services, • Principles of RFID, • Components of an RFID system, • RFID reader, • Tags, middleware, • Sensor nodes, • Connecting nodes, • Networking nodes.	**07 Hrs**
Unit-IV IoT Systems • Hardware and Software: Introduction to Raspberry Pi, • Familiar with Raspberry Pi hardware, • Study of I/O ports, • Programming with Raspberry Pi: Study of operating system, simple programs in C / C++, Introduction with Python programming.	**08 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	3									2	2
2	2	2	2									2	2
3	2	2	2									2	2
4	2	2	2									2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

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Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	The Internet of Things - Connecting objects to the web	--	HakimaChaouchi	Wiley Publications	--
2	Building the Internet of Things	--	Daniel Minoli	Wiley Publications	--

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Internet of Things	-	Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram	John Wiley & Sons	-
2	Architecting the Internet of Things	-	Bernd Scholz, Reiter	Springer	-

Useful Link /Web Resources:

1DELNET- http://www.delnet.in
2NDL-http://ndl.iitkgp.ac.in
3 N-LIST- http://www.nlist.inflib.ac.in

Course Title: Environmental Studies	
Course Code: CSE24VEC226	**Semester: IV**
Teaching Scheme: L-T-P: 2-0-0	**Credits: 2**
Evaluation Scheme:-ISE- I(10 Marks), ISE-II (10 Marks) INT-30	**ESE : -**
Prerequisite:	This course is imparting fundamental knowledge and awareness of Environmental Studies among students and importance of conservation of environment.

Course Objectives:

1.	Study scope and importance of natural resources, ecosystems, biodiversity for creating awareness and their conservation in multiple disciplines.
2.	Learn various types of pollution, their impacts and control measures for minimizing pollution and sustainable development.
3	Understand social issues related to the environment, environmental ethics and human rights towards the environment.
4.	Study various laws and regulations related to environment and its applicability in society and industries.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Summarize natural resources, importance of ecosystem and conservation of biodiversity with respect to multiple disciplines	Apply
2	Explain causes, effects, solutions for various pollution problems and its minimization strategies.	Apply
3	Interpret environmental ethics and their implementation for betterment of environment and human life.	Apply
4	Outline the requirements of laws and regulations for environmental conservation and applicability of legislations in society and industries.	Apply

Curriculum Details

Course Contents	Duration
UNIT I: Nature of Environmental Studies: • Definition, scope and importance. Multidisciplinary nature of environmental studies. Need for public awareness.	**02Hrs**
UNIT II: Natural Resources and Associated Problems • **Forest resources**: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. • **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. • **Mineral resources**: Usage and exploitation. Environmental effects of extracting and using mineral resources. • **Food resources:** World food problem, changes caused by effect of modern agriculture,	**05Hrs**

fertilizer-pesticide problems. • **Energy resources:** Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. • **Land resources:** Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of individuals in conservation of natural resources	
UNIT III: Ecosystems and Value of biodiversity • Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. • Types, characteristics features, structure and function of **any one** of the following ecosystem :- a. Forest ecosystem, b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, Estuaries). • Definition, types of biodiversity, consumptive use, productive use, social, ethical, aesthetic and option values. • India as a mega diversity nation. • Ghats as a biodiversity region. Hot-spot of biodiversity. Threats to biodiversity. • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**10 Hrs**
UNIT IV: Environmental Pollution, Social Issues & Environmental Protection • Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards • Role of an individual in prevention of pollution) • Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. • Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. • Environmental Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act. • Wildlife Protection Act. • Forest Conservation Act. • Population Growth and Human Health, Human Rights.	**13 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	2	1	-	-	-	2	3	-	-	-	-	2	-
2	3	2	2	-	-	2	3	-	-	-	1	3	2
3	1	1	-	-	-	3	3	3	-	2	-	2	1
4	2	2	-	-	-	3	3	2	-	2	1	2	2

Text Books:

1. Environmental Studies by Dr.P.D.Raut (Shivaji University, Kolhapur)

Reference Books:

1. Miller T.G. Jr., Environmental Science. Wadsworth Publications Co.(TB).

2. Odum, E.P.1971, Fundamentals of Ecology, W.B. Saunders Co. USA, 574p

3. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I and II, Environmental Media (R)

Course Title :-Technologies used for Project Management and Start-Up	
Course Code:-CS24-228	**Semester:- IV**
Teaching Scheme L-T-P :1-0-0	**Credits : 1**
Evaluation Scheme: ISE- I (10 Marks), ISE- II (15 Marks), INT- 25 Marks	**ESE: -**
Prerequisite-	-

Course Objectives:

1	To understand project management fundamentals, including lifecycles and stakeholder roles.
2	To learn planning techniques and communication strategies for successful projects.
3	To explore the start-up ecosystem, including key players, growth stages, and challenges.
4	To develop skills in building and pitching start-up ideas using project management and entrepreneurial tools.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand and explain project management and startup fundamentals.	Understand
2	Apply WBS, SMART goals & gantt chart in project planning.	Apply
3	Analyze resource management strategies and communication effectively.	Analysing
4	Analyze the startup landscape, including key players, growth stages, challenges, and opportunities.	Analysing
5	Create and present innovative startup ideas with project plans, MVPs, and pitch decks using entrepreneurial tools	Create

Curriculum Details

Course Contents	Duration
Unit 1: Project Management Fundamentals and Planning & Scheduling and Resource Management & Communication • Understanding Projects: Definition, • Lifecycle (Initiation, Planning, Execution, Monitoring & Control, Closure). • Project Stakeholders: Roles and Responsibilities (Project Manager, Team Members, Clients). • Importance of Project Management: Benefits across Engineering Disciplines, • Importance in Different Industries. • Project Management Methodologies: Traditional vs. Agile Project Management Approaches. • Introduction to Project Management Software: Exploring features of popular project management tools (e.g., Asana, Trello, etc.). **Project Planning Techniques:** • Work Breakdown Structure (WBS) for Task Breakdown. • Setting SMART Goals: Specific, Measurable, Achievable, Relevant, Time-bound. • Project Scheduling: Introduction to Gantt Charts and Dependency Management. • Project Management Software: Using Features for Planning and Scheduling.	**8 Hrs**

Course Contents	Duration
• Resource Management: Identifying and Allocating Human & Material Resources. • Effective Communication: Strategies for Clear & Timely Updates to Stakeholders. • Communication Tools: Utilizing Features within Project Management Software.	
Unit-II The Start-up Ecosystem, Developing a Start-up, Putting It Into Practice • Minimum Viable Product M CMVP): Building Basic Version for Initial Validation. • Lean Start-up Methodology: Build-Measure-Learn Cycle for Continuous Improvement. • Crafting a Start-up Pitch: Identifying Key Elements and Storytelling Techniques. • Presenting Your Start-up Idea: Developing a Pitch Deck using Design Tools. • Start-up Landscape: Key Players (Entrepreneurs, Investors, Accelerators). • Start-up Growth Stages: Ideation, Validation, Scaling, Challenges & Opportunities for Start-ups. • Technology for Start-ups: Online Tools for Market Research, Competitor Analysts, Customer Discovery, and Surveys, • Introduction to the Business Model Canvas as a tool for visualizing and refining start up ideas. • Develop a project management plan for a simulated engineering project (scope, schedule, resources); • Present your plan and receive feedback (optional; include Budget considerations). • **Develop a Start-up Idea & Pitch:** Identify a problem (engineering or general) and propose a 2 solution (your start up idea): Build (Optional): Create a basic Minimum Viable Product (MVP) prototype (online tools/basic coding); Pitch: Present your start up idea focusing on the problem, solution, and target market.	**7Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	-	-	-	-	2	-	2	-	-	-	3	-
2	2	-	-	-	3	2	-	-	-	-	3	-	3
3	-	2	-	-	-	2	-	-	2	3	-	-	2
4	-	3	-	-	-	2	-	2	-	-	-	3	-
5	-	-	3	-	2	-	-	-	-	-	3	-	3

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Project Management: A Systems Approach to Planning, Scheduling, and Controlling	12th	Harold Kerzner	Baron's Educational Series. (New York)	2003
2	Lean Startup: How Today's		Eric Ries		

Sr. No	Title	Edition	Author(s)	Publisher	Year
	Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses				

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Scrum: The Art of Doing Twice the Work in Half the Time		Jeff Sutherland		
2	The Startup Way: How Modern Companies Use Entrepreneurial Management to Transform Culture and Drive Long-Term Growth	First Edition	Don Bluth,	DH Press	2014

Useful Link /Web Resources:

1. Y Combinator: https://www.ycombinator.com/library
2. https://www.ycombinator -how-to-get-startup-ideas/carousel Startup%20School

Course Title:Technologies used for Project Management and Start-Up	
Course Code :CS24-228L	**Semester: I**
Teaching Scheme: L-T-P: 0-0-2	**Credit : 1**
Evaluation Scheme: INT: 25 Marks	**ESE/POE/OE Marks: -**
Prior Knowledge of:	**No Prerequisite Required.**

Course Objectives:

1.	To understand project management fundamentals, including lifecycles and stakeholder roles.
2.	To learn planning techniques and communication strategies for successful projects.
3.	To explore the start-up ecosystem, including key players, growth stages, and challenges.
4.	To develop skills in building and pitching start-up ideas using project management and entrepreneurial tools.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand and explain project management and startup fundamentals by effectively applying WBS,SMART goals &gantt chart in project planning.	Understand
2	Analyze resource management strategies and communication effectively.	Analyze
3	Analyze the startup landscape, including key players, growth stages, challenges, and opportunities.	Analyze
4	Create and present innovative startup ideas with projectalans, MVPs, and pitch decks using entrepreneurial tools	Create

List of Experiments-

Exp. No	Title of Experiments	Duration
01	**Project Life Cycle Simulation (Lab 1):** Simulate a project lifecycle using a board game or online tool. Players take on roles (project manager, team members, client) and experience the different phases (Initiation, planning, execution, monitoring & control, closure),	2 Hrs
02	**Stakeholder Identification & Responsibilities (Lab 2):** Choose a real-world project (eg, campus event, building renovation) and identify key 0 stakeholders. Analyze their roles, responsibilities, and communication needs.	2 Hrs
03	**Work Breakdown Structure (WBS) Creation (Lab 3):** Select a common engineering task (eg, designing a bridge, building a robot), Break down the task into a hierarchical WBS using project management	2 Hrs

Exp. No	Title of Experiments	Duration
	software. (eg. Asana, Trello) or a mind map tool.	
04	**SMART Goal Setting & Scheduling (Lab 4):** Define SMART goals for a personal or academic project. Use project management software to create a schedule with tasks, deadlines, & dependencies using Gantt charts.	2 Hrs
05	**Resource Allocation & Management (Lab 5):** Simulate a resource allocation scenario. Students are assigned limited resources (eg. materials, budget) and tasked with completing project tasks within those constraints, Analyze trade-offs and resource conflicts.	2 Hrs
06	**Communication Plan Development (Lab 6):** Develop a communication plan for a hypothetical engineering project, Identify stakeholders, communication channels (meetings, emails), and compitation frequency	2 Hrs
07	**Startup Ecosystem Research (Lab 7):** Research a specific industry and identify key players (entrepreneurs, investors, accelerators) relevant to startups in that field.	2 Hrs
08	Business Model Canvas Workshop (Lab 8): Conduct a workshop where students learn about and practice using the Business O Model Canvas to explore potential startup ideas.	2 Hrs
09	Minimum Viable Product (MVP) Prototyping (Lab 9): Students choose their startup ideas (developed in Unit 6) and create a basic MVP 0 prototype using online tools or basic coding (optional).	2 Hrs
10	Pitch Deck Creation (Lab 10): Using design tools and presentation software, students develop a pitch deck for their startup ideas, highlighting the problem, solution, target market, and team.	2 Hrs

Course Articulation Matrix: Mapping of Course Outcomes (Cos) with Program Outcomes (PO's)

PO's / CO's	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	-	-	-	-	2	-	2	-	-	-	3	-
2	2	-	-	-	3	2	-	-	-	-	3	-	3
3	-	2	-	-	-	2	-	-	2	3	-	-	2
4	-	3	-	-	-	2	-	2	-	-	-	3	-

Strongly Contribution:3 Moderate Contribution:2 Weak Contribution:1 No Contribution--

Suggested Learning Resources: --

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Project Management: A Systems Approach to Planning, Scheduling, and Controlling	12th	Harold Kerzner	Baron's Educational Series. (New York)	2003
2	Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically		Eric Ries		

	Successful Businesses				

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Scrum: The Art of Doing Twice the Work in Half the Time		Jeff Sutherland		
2	The Startup Way: How Modern Companies Use Entrepreneurial Management to Transform Culture and Drive Long-Term Growth	First Edition	Don Bluth,	DH Press	2014

Useful Link /Web Resources:

1. Y Combinator: https://www.ycombinator.com/library
2. https://www.ycombinator -how-to-get-startup-ideas/carousel Startup%20School

D.Y.PATIL TECHNICALCAMPUS

FACULTYOFENGINEERING& FACULTYOFMANAGEMENT,

(An Autonomous Institute)

Department of Computer Science & Engineering

S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Title :- Java Programming	
Course Code:- CSE24VSEC228	**Semester:- IV**
Teaching Scheme L-T-P : 2-0-0	**Credits : 2**
Evaluation Scheme: INT (25 Marks)	**POE: 50 Marks**
Prerequisite:	PSD24FE125- Object Oriented Programming Skill Development OOP

Course Objectives:

1	To explain fundamental and object oriented concepts of Java.
2	To distinguish OOP concepts implementation in Java compared to C++.
3	To expose students to advanced features in Java.
4	To develop console applications using Java such as chatting server, student management system etc.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Use knowledge of fundamental and OOP concepts for programming.	Apply
2	Apply knowledge of advanced features in Java.	Apply
3	Apply knowledge of various concepts of computer science and design solutions for different subjects like threading, networking, and database.	Apply
4	Develop simple applications. Example: (Student's basic profile.)	Apply

Curriculum Details

Unit 1:---Fundamental Programming in Java: • The Java Buzzwords, • The Java Programming Environment-JVM, • JIT Compiler, • Byte Code Concept, • Hot Spot, • A Simple Java Program, • Source File Declaration Rules, Comments, Data Types, • Variables, Operators, Strings, Input and Output, Control Flow, Big Numbers, Arrays, Jagged Array. • Objects and Classes: Object- Oriented Programming Concepts, • Declaring Classes, • Declaring Member Variables, • Defining Methods, Constructor, • Passing Information to a Method or a Constructor, • Creating and using objects, • Controlling Access to Class Members, • Static Fields and Methods, this keyword, • Object Cloning, • Class Design Hints.	**5 Hrs**

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Unit 2:--- Interface, Inheritance and Packaging : • Interfaces: Defining an Interface, • Implementing an Interface, • Using an Interface as a Type, • Evolving Interfaces, • Default Methods. • Inheritance: Definition, Super classes and Subclasses, • Overriding and Hiding Methods, • Polymorphism, • Inheritance Hierarchies, • Super keyword, • Final Classes and Final Methods, • Abstract Classes and Abstract Methods, • Casting, • Design Hints for Inheritance, • Nested classes & Inner Classes, • Finalization and garbage collection. • Packages: Class importing, creating a Package, Naming a Package, Using Package Members, Managing Source and Class Files. • Developing and deploying (executable) Jar File.	**7 Hrs**
Unit 3:---Exception and I/O Streams: • Exception: Definition, Dealing with Errors, • The Classification of Exceptions, • Declaring Checked Exceptions, • Throw an Exception, • Creating Exception Classes, • Catching Exceptions, • Catching Multiple Exceptions, • Re-throwing and Chaining Exceptions, finally clause, • Advantages of Exceptions, • Tips for Using Exceptions. • I/O Streams: Byte Stream – InputStream, OutputStream, DataInputStream, DataOutputStream, FileInputStream, FileOutputStream, CharacterStreams, BufferedStream, Scanner, File, Random Access File.	**6 Hrs.**

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Unit 4:--- Networking, Multithreading and Database: • Networking: Overview of Networking, • Networking Basics, • Working with URLs, • Creating a URL, • Parsing a URL, • Reading Directly from a URL, • Connecting to a URL, • Reading from and Writing to a URL Connection, • Sockets, • Reading from and Writing to a Socket, • Writing the Server Side of a Socket, • Datagrams, • Writing a Datagram Client and Server. • Multithreading: Processes and Threads, • Runnable Interface and Thread Class , • Thread Objects, • Defining and Starting a Thread, • Pausing Execution with Sleep, • Interrupts, • Thread States, • Thread Properties, • Joins, • Synchronization. • Database Programming: The Design of JDBC, The Structured Query	**12 Hrs.**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO 1	PSO 2
1	3	2	2	-	-	-	-	-	-	-	2	-	1
2	3	3	3	-	-	-	-	-	-	-	1	1	2
3	3	3	3	-	-	-	-	-	-	-	2	1	2
4	3	3	2	-	-	-	-	-	-	-	2	1	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Core Java- Volume I Fundamentals		Cay Horstmann and Gary Cornell	Pearson	
2	Core Java- Volume II Advanced Features	8th edition	Cay Horstmann and Gary Cornell	Pearson	

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Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	The Java Tutorial: A Short Course on the Basics	6th Edition	Raymond Gallardo, Scott Hommel, Sowmya Kannan	Addison-Wesley Professional	
2	JAVA-The Complete Reference	9th Edition	Herbert Schildt	OraclePress, McgrawHill	
3	A Programmer's guide to JAVA SCJP Certification	3rd Edition	Khaleed Mughal and Rolf W. Rasmussen	Addison Wesley	

Useful Link /Web Resources:

1. The Java Tutorials From ORACLE Java Documentation
URL:http://docs.oracle.com/javase/tutorial/(Refer For All Units)

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S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Title: Java Programming Lab	
Course Code : CSE24VSEC228P	**Semester: IV**
Teaching Scheme: L-T-P: 0-0-2	**Credit : 1**
Evaluation Scheme: INT (25 Marks)	**POE: 50 Marks**
Prerequisite:	PSD24FE125- Object Oriented Programming Skill Development

Course Objectives:

1	To explain fundamental and object oriented concepts of Java.
2	To distinguish OOP concepts implementation in Java compared to C++.
3	To expose students to advanced features in Java.
4	To develop console applications using Java such as chatting server, student management system etc.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Use knowledge of fundamental and OOP concepts for programming.	Apply
2	Apply knowledge of advanced features in Java.	Apply
3	Apply knowledge of various concepts of computer science and design solutions for different subjects like threading, networking, and database.	Apply
4	Develop simple applications. Example: (Student's basic profile.)	Apply

List of Experiments-

Exp. No	Title of Experiments	Duration
01	Develop a Java Program to implement class and create its objects.	2 Hrs
02	Create Separate Engine, Tyre and Door Class. Create a Car class as parent class of these classes. And show functionality of each component in the car.	2 Hrs
03	Developing Java program with interface inheritance.	2 Hrs
04	Develop a mathematical package for Statistical operations like Mean, Median, Average, Standard deviation. Create a sub package in the math package-convert. In "convert" package provide classes to convert decimal to octal, binary, hex and vice-versa. Develop application program to use this package, and build executable jar file of it.	2 Hrs

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05	Develop a class Expr to create and evaluate given expression. Constructor accepts the expression as String. For example, Expr("x^2") or Expr("sin(x)+3*x"). If the parameter in the constructor call does not represent a legal expression, then the constructor throws an IllegalArgumentException. The message in the exception describes the error. Provide eval(double num) and eval(int num) method to evaluate given expression and return evaluated answer. For example, if Expr represents the expression 3*x+1, then func. value(5) is 3*5+1, or 16. Finally, get Definition() returns the definition of the expression. This is just the string that was used in the constructor that created the expression object.	2 Hrs
06	Write a class to represent Roman numerals. The class should have two constructors. One constructs a Roman numeral from a string such as "XVII" or "MCMXCV". It should throw a NumberFormatException if the string is not a legal Roman numeral. The other constructor constructs a Roman numeral from an int. It should throw a NumberFormatException if the int is outside the range 1 to 3999. In addition, the class should have two instance methods. The method to String() returns the string that represents the Roman numeral. The method toInt() returns the value of the Roman numeral as an int.	2 Hrs
07	Take file name as input to your program, If file exists then open and display contents of the file. After displaying contents of file ask user – do you want to add the data at the end of file. If a user gives yes as response, then accept data from user and append it to file. If file does not exist then create a fresh new file and store user data in to it. User should type exit on new line to stop the program.	2 Hrs
08	Take Student information such as name, age, weight, height, city, phone from user and store it in the file using DataOutputStream and FileOutputStream and Retrieve data using DataInputStream and FileInputStream and display the result.	2 Hrs
09	Write a program to implement Chatting Program.	2 Hrs
10	Write a Console based program to create a student registration and Login. Store Registration data in file and take Login information from file.	2 Hrs

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	2	2	-	-	-	-	-	-	-	2	-	1
2	3	3	3	-	-	-	-	-	-	-	1	1	2
3	3	3	3	-	-	-	-	-	-	-	2	1	2
4	3	3	2	-	-	-	-	-	-	-	2	1	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Core Java- Volume I Fundamentals		Cay Horstmann and Gary Cornell	Pearson	
2	Core Java- Volume II Advanced Features	8th edition	Cay Horstmann and Gary Cornell	Pearson	

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	The Java Tutorial: A Short Course on the Basics	6th Edition	Raymond Gallardo, Scott Hommel, Sowmya Kannan	Addison-Wesley Professional	
2	JAVA-The Complete Reference	9th Edition	Herbert Schildt	OraclePress, McgrawHill	
3	A Programmer's guide to JAVA SCJP Certification	3rd Edition	Khaleed Mughal and Rolf W. Rasmussen	Addison Wesley	

Useful Link /Web Resources:

1. The Java Tutorials From ORACLE Java Documentation
URL:http://docs.oracle.com/javase/tutorial/(Refer For All Units)

D.Y.PATIL TECHNICALCAMPUS

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Department of Computer Science & Engineering

S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2024-2025

Course Title :- Mini Project using S/W Engineering Lifecycle	
Course Code:- CS24-223L	**Semester:- IV**
Teaching Scheme L-T-P : 0-0-4	**Credits : 2**
Evaluation Scheme: INT(50 Marks)	**POE: 50 Marks**
Prerequisite-	PSCL24FE113- Problem Solving with C-Language, DS24FE124- Data Structure PSD24FE125- Object Oriented Programming

Course Objectives:

1	To formulate the problem statement.
2	To follow the SDLC model for development of project.
3	To develop the logical skills and use of appropriate data structures for solving the engineering problems.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	**Statements**	**BTL**
1	Define appropriate problem statements for real world problems.	Remembering
2	Organize an effective project plan with clear objectives and prepare a synopsis.	Analyzing
3	Design the various modules of the project to provide a solution to the problem with the help of various design tools.	Evaluating
4	Develop the proposed system using suitable development platform.	Creating

Curriculum Details:

Course Contents

- The Project should be undertaken preferably by a group of 3-4 students who will jointly work and implement the project.
- The group will select a project with the approval from the domain expert panel and submit the name of the project with a synopsis.
- The Project should consist of defining the problem and analyzing it, designing the solution and implementing it using a suitable programming language.
- A presentation and demonstration based on the above work is to be given by the group for ISE. The work will be jointly assessed twice in a semester by an internal domain expert panel. A hard copy of the project report of the work done is to be submitted along with the softcopy of the project during ESE. The problems can be referred from the web links concerned with ACM-ICPC.

Project topics may be selected from following :

- Real world applications
- Probability and Statistics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

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POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	-	1	-	1	1	1	3	3	2	2	-
2	3	3	-	1	1	1	1	1	3	3	2	2	-
3	3	3	2	1	1	1	1	1	3	3	2	2	1
4	3	3	2	-	2	1	1	1	3	3	2	2	3

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

Useful Link /Web Resources:

- https://icpc.global/
- https://www.sih.gov.in/

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S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2024-2025

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Course Title :- Fundamentals of Cyber security	
Course Code:- CSE24HC2212	**Semester:- IV**
Teaching Scheme L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme Evaluation Scheme: ISE-I (10 Marks), MSE (30 Marks), ISE-II (10 Marks)	**ESE Marks: 50 marks**
Prerequisite-	CNF24FE114-Computer and Network Fundamentals

Course Objectives:

CO	Statement
1	To understand the basic concepts of cyber-Security.
2	To study different attacks in cyber-crimes.
3	To understand different tools and methods used in cyber-crime.
4	To study cyber security challenges and implications.
5	To know about Cyber Security Organizational Issues, Policies.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Understand basic concepts of Cyber Crimes.	Understand
2	Identify the attacks in Cyber Crimes	Apply
3	Able to specify the suitable methods used in Cyber Crime	Understand
4	Ability to face cyber security challenges	Understand
5	Understand Cyber Security	Understand

Curriculum Details

Course Contents	Duration
UNIT I-Introduction to Cyber Security: • Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, • Internet Governance – Challenges and Constraints, Computer Criminals, • CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, • Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, • IP spoofing, Methods of defence, Security Models, risk management, • Cyber Threats-Cyber Warfare, • Cyber Crime, Cyber terrorism, Cyber Espionage, etc. • Comprehensive Cyber Security Policy	**8Hrs**
UNIT II-Cyber Offenses: • How Criminals Plan Them: Introduction, • How Criminals plan the Attacks • Social Engineering • Cyber stalking • Cyber cafe and Cybercrimes • Botnets: The Fuel for Cybercrime • Attack Vector • Cloud Computing	**8 Hrs**

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UNIT III-Overview of Mobile and Wireless Devices and Associated Risks: • Introduction, Proliferation of Mobile and Wireless Devices, • Trends in Mobility, • Credit card Frauds in Mobile and Wireless Computing Era, • Security Challenges Posed by Mobile Devices, • Registry Settings for Mobile Devices	**7 Hrs**
UNIT IV Security Measures and Organizational Policies for Mobile Computing • Authentication service Security, • Attacks on Mobile/Cell Phones, • Mobile Devices: Security Implications for Organizations, • Organizational Measures for Handling Mobile, • Organizational Security Policies an Measures in Mobile Computing Era, Laptops.	**7 Hrs**
UNIT V-Types of Attacks and Cybercrime: • Introduction • Proxy Servers and Anonymizers, • Phishing, Password Cracking, • Keyloggers and Spywares, • Virus and Worms, Trojan Horse and Backdoors, • Steganography, DoS and DDoS attacks, • SQL Injection, Buffer Overflow.	**7 Hrs**
UNIT VI-Cyber Security Organizational Policies, Risk and Challenges: • Introduction, • Cost of Cybercrimes and IPR issues, • Web threats for Organizations, • Security and Privacy Implications, • Social media marketing: Security Risks and Perils for Organizations, • Social Computing and the associated challenges for Organizations.	**8Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (Cos) with Program Outcomes (Pos)

Pos Cos	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	1	-	-	-	1	-	-	-	-	-	-	1
2	2	3	1	-	-	-	-	-	-	-	-	-	-
3	1	2	3	-	2	-	-	-	-	-	-	-	-
4	1	2	2	1	1	-	-	1	-	1	0	1	-
CO5	3	1	2	1	1	1	-	-	-	-	-	-	-

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution- -

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Understanding Cyber Crimes, Computer Forensics and Legal Perspectives		Nina Godbole and Sunil Belapure	Wiley INDIA	

Reference Books:

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Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press				
2	Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group				

Useful Link /Web Resources:

1. DELNET- http://www.delnet.in
2. NDL-http://ndl.iitkgp.ac.in
3. https://archive.nptel.ac.in/courses/106/105/106105183/
4. https://www.tpointtech.com/computer-network

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S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2024-2025

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Course Title: Fundamentals of Cyber security	
Course Code : CSE24HC2212P	**Semester: V**
Teaching Scheme: L-T-P: 0-0-2	**Credit : 1**
Evaluation Scheme: INT: 25 Marks	**POE/OE: -**
Prior Knowledge of:	Fundamentals of Cyber security

Course Objectives:

CO	Statement
1	To understand the basic concepts of cyber-Security.
2	To study different attacks in cyber-crimes.
3	To understand different tools and methods used in cyber-crime.
4	To study cyber security challenges and implications.
5	To know about Cyber Security Organizational Issues, Policies.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	**Statements**	**BTL**
1	Understand basic concepts of Cyber Crimes.	Understand
2	Identify the attacks in Cyber Crimes	Apply
3	Able to specify the suitable methods used in Cyber Crime	Understand
4	Ability to face cyber security challenges	Understand
5	Understand Cyber Security	Understand

List of Experiments-It should consist of 10-12 experiments based on the syllabus.

Exp. No	**Title of Experiments**	**Duration**
01	Study of concept of layered security.	2 Hrs
02	Analyze a case study of a breached organization focusing on Confidentiality, Integrity, and Availability (CIA).	
03	Set up network monitoring tools (e.g., Wireshark) to capture traffic and analyze for anomalies or potential attacks.	2 Hrs
04	Use a vulnerability scanner (like Nessus/OpenVAS) to analyze a sample network. Report on discovered vulnerabilities and threats.	2 Hrs
05	Case Study: The Twitter Bitcoin Scam (2020)	2 Hrs
06	Case Study: The Use of Cyber Cafés in Identity Theft	2 Hrs
07	Case Study: Evaluate different security models (e.g., Bell-LaPadula, Biba, Clark-Wilson) on a case study scenario. Discuss the pros and cons of each model.	2 Hrs
08	Demonstrate how keyloggers capture keystrokes and methods to detect them.	2 Hrs
09	Develop a simple virus or worm that replicates and spreads across a local network	2 Hrs
10	Develop a simple C program with a buffer overflow vulnerability	2 Hrs
11	Conduct a case study on a high-profile internet governance issue, like net neutrality or data privacy laws in different countries.	2 Hrs

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12	Case Study: Examine the role of international laws and agreements on cyber security measures.	2 Hrs

Course Articulation Matrix: Mapping of Course Outcomes (Cos) with Program Outcomes (PO's)

PO's CO's	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	1	0	0	0	1	0	0	0	0	0	0	1
2	2	3	1	0	0	0	0	0	0	0	0	0	0
3	1	2	3	0	2	0	0	0	0	0	0	0	0
4	1	2	2	1	1	0	0	1	0	1	0	1	0
	3	1	2	1	1	1	0	0	0	0	0	0	0

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution:1 No Contribution--

Suggested Learning Resources: --

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Understanding Cyber Crimes, Computer Forensics and Legal Perspectives		Nina Godbole and Sunil Belapure	Wiley INDIA	

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press				
2	Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group				

Useful Link /Web Resources:

1. https://www.w3schools.com/cybersecurity/
2. **https://www.knowledgehut.com/blog/security/cyber-security-fundamentals**

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S. Y. B. Tech. Curriculum

(Programme-Computer Science & Engineering) w. e. f. A.Y. 2025-2026

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Course Title :- Introduction to Data Science	
Course Code:- CSE24DM2212	**Semester:- IV**
Teaching Scheme L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme: ISE-I (10 Marks), MSE (30 Marks), ISE-II (10 Marks)	**ESE Marks: 50 marks**
Prerequisite-	AS24FE111- Algebra and Statistics DIC24FE121- Differential & Integral Calculus

Course Objectives:

1	To study basic knowledge of data science and its processes.
2	To understand visualize the data using data visualization tools.
3	To understand different methods for data analysis.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Explain basic concepts of data science.	Understand
2	Describe data science process for the problem solving	Understand
3	Demonstrate to select appropriate visualization techniques for given problem	Apply
4	Describe different statistical methods for data analysis.	Understand

Curriculum Details

Course Contents	Duration
Unit-I Introduction • Introduction to data science, • Why learn data science? • Data analytics lifecycle, • Types of data analysis, • Types of jobs in Data Analytics, • Data science tools, • Fundamental areas of study in data science, • Pros and Cons of data science	**07 Hrs**
Unit-II Data Science in big data world • Benefits and uses of data science and big data, • Facets of data, • The data science process, • The big data ecosystem and data science	**07 Hrs**

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Unit-III Data Pre-processing • Introduction, • Data types and forms, • Possible data error types, • Various data pre-processing operations: data cleaning, data integration, data transformation, data reduction, data discretization	**07 Hrs**
Unit-IV Data Science Process • Introduction, • Defining research goals and creating project charter, • Retrieving data, • Exploratory data analysis, • Build the models, • Presenting findings and building applications	**07 Hrs**
Unit-V Data Visualization • Introduction, • Visual encoding, • Data visualization software, • Data visualization libraries, • Basic data visualization tools, • Specialized data visualization tools, • Advanced data visualization tools, • Visualization of geospatial data, • Data visualization types	**07 Hrs**
Unit-VI Statistical Data Analysis • Role of statistics in data science, • Kinds of statistics – descriptive statistics, inferential statistics, • Probability theory – random variables, independence, sample space, • Odds and risks, • Expected values, • Standard errors, • Probability distribution	**07 Hrs**

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	3	-	-	-	-	-	-	-	-	2	2
2	3	3	3	-	-	-	-	-	-	-	-	2	2
3	3	3	3	-	2	-	-	-	-	-	-	2	2
4	3	3	3	-	-	-	-	-	-	-	-	2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Introducing Data Science	--	Davy Cielen, D. B. Meysman, Mohamed Ali	Manning Publications	--
2	Data Science Fundamentals and Practical Approaches	--	Gypsi Nandi, Rupam Kumar Sharma	BPB Publication	--

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Essentials of Data Science and Analytics	--	Amar Sahay	O'REILLY Publication	--
2	Fundamentals of Data Science	--	Sanjeev Wagh, Manisha Bhende&AnuradhaThakare	CRC Press	--

Useful Link /Web Resources:

1DELNET- http://www.delnet.in

2NDL-http://ndl.iitkgp.ac.in

3 N-LIST- http://www.nlist.inflib.ac.in

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:

Course Title: Introduction to Data Science Laboratory	
Course Code : CSE24DM2212P	**Semester: IV**
Teaching Scheme: L-T-P: 0-2-0	**Credit : 1**
Evaluation Scheme: INT: 25 Marks	**ESE/POE/OE Marks: -**
Prerequisite-	AS24FE111- Algebra and Statistics DIC24FE121- Differential & Integral Calculus

Course Objectives:

1.	To study basic knowledge of data science and its processes.
2.	To understand visualize the data using data visualization tools.
3.	To understand different methods for data analysis.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements	BTL
1	Explain basic concepts of data science.	Understand
2	Describe data science process for the problem solving	Understand
3	Demonstrate to select appropriate visualization techniques for given problem	Apply
4	Describe different statistical methods for data analysis.	Understand

List of Experiments-

Exp. No	Title of Experiments	Duration
01	Study of descriptive statistics.	02 Hrs
02	Study of inferential statistics.	02 Hrs
03	Study of probability distribution.	02 Hrs
04	Study of structure and main characteristics of data science.	02 Hrs
05	Write a program to loading and exploring datasets.	02 Hrs
06	Write a program to perform cleaning and pre-processing of data.	02 Hrs
07	Write a program to perform data visualization using different types of techniques.	02 Hrs
08	Case Study: R studio.	02 Hrs
09	Case Study: Tableau.	02 Hrs
10	Case Study: PowerBI.	02 Hrs

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs COs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
1	3	3	3	-	-	-	-	-	-	-	-	2	2
2	3	3	3	-	-	-	-	-	-	-	-	2	2
3	3	3	3	-	2	-	-	-	-	-	-	2	2
4	3	3	3	-	-	-	-	-	-	-	-	2	2

Strongly Contribution: 3 Moderate Contribution: 2 Weak Contribution: 1 No Contribution--

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Introducing Data Science	--	Davy Cielen, D. B. Meysman, Mohamed Ali	Manning Publications	--
2	Data Science Fundamentals and Practical Approaches	--	Gypsi Nandi, Rupam Kumar Sharma	BPB Publication	--

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Essentials of Data Science and Analytics	--	Amar Sahay	O'REILLY Publication	--
2	Fundamentals of Data Science	--	Sanjeev Wagh, Manisha Bhende&AnuradhaThakare	CRC Press	--

Useful Link /Web Resources:

1 DELNET- http://www.delnet.in

2 NDL-http://ndl.iitkgp.ac.in

3 N-LIST- http://www.nlist.inflib.ac.in