Detailed Syllabus
Lecture-wise Breakup

Subject Code	24M11CA116 NBA Code- **CMAC106**	**Semester: Even** **(specify Odd/Even)**	**Semester** II **Session** 2024 -2025 **Month from:** Jan 2025 to June 2025
Subject Name	Design and Analysis of Algorithms		
Credits		**Contact Hours**	

Faculty (Names)	**Coordinator(s)**	Dr Shelendra Pal
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C106.1	Explain complexity classes, the concept of algorithms, asymptotic analysis, and fundamental problem-solving approaches	Understand Level (Level 2)
C106.2	Apply standard algorithms to solve core problems such as sorting, searching, and graph-based challenges.	Apply Level (Level 3)
C106.3	Evaluate and select suitable algorithm design strategies for solving specific problems.	Analyze Level (Level 4)
C106.4	Develop efficient algorithms to address and solve complex computational problems.	Create Level (Level 6)

Module No.	**Subtitle of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction	Algorithm, analysis, time complexity and space complexity, O-notation, Omega notation and Theta notation, Heaps and Heap sort, Sorting in linear time	6
2.	Divide and Conquer	Fundamentals of Divide and Conquer (D&C) approach using Binary search, Quick sort, and Merge sort; Strassen's matrix multiplication; Closest pair.	4
3.	Greedy Algorithms	General Strategy, Knapsack problem, Job sequencing with Deadlines, Optimal merge patterns, Minimal Spanning Trees and Dijkstra's algorithm. Fractional and 0/1 Knapsack; Coinage problem; Bin packing; Job scheduling – Shortest job first, Shortest remaining job first, etc.; Graph coloring; and Text compression using Huffman coding and Shannon-Fanon coding, etc.	6
4.	Backtracking Algorithms	Backtracking: General Strategy, 8 Queen's problem, Graph Coloring, Hamiltonian Cycles, 0/1 Knapsack	6
5.	Dynamic Programming	Fundamentals of Dynamic programming-based solution approach; 0/1 Knapsack; Shortest path using Floyd Warshall; Coinage problem; Matrix Chain Multiplication; Longest common subsequence; Longest increasing sequence, String editing, etc.	7
6.	String Algorithms	Naïve String Matching, Finite Automata Matcher, Rabin Karp matching algorithm, Knuth Morris Pratt	6
7.	Problem Spaces and	Problem Spaces: States, goals and operators, Uninformed	5

	Problem solving by search	search (BFS, DFS, DFS with iterative deepening), Heuristics and informed search (hill-climbing, generic best-first, A*)	
8.	Tractable and Non-Tractable Problems	Efficiency and Tractability, P, NP, NP-Complete, NP-Hard problems	2
		Total number of Lectures	**42**

Evaluation Criteria

T1	20 Marks
T2	20 Marks
End Semester Examination	35 Marks
TA	25 Marks(Attendance/Mini-project/Coding Contest/Hackathon)

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on data structures algorithms. The students can opt any real-world application where these algorithms can be applied. The students have to implement the mini project using C/C++/Java language. Project development and its presentation will enhance coding skills, knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. **(Reference Books,** Journals, Reports, Websites etc. in the IEEE format)	
1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, MIT Press, 3rd Edition, 2009
2.	Steven Skiena,The Algorithm Design Manual, Springer; 2nd edition, 2008
3.	Knuth, The art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional; 3rd edition,1997
4.	Horowitz and Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 2008
5.	Sedgewick, Algorithms in C, 3rd edition. Addison Wesley, 2002
6.	Alfred V. Aho, J.E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983
7.	ACM Transactions on Algorithms (TALG)
8.	Algorithmica Journal, Springer
9.	Graphs and Combinatorics, Journal, Springer
10.	The ACM Journal of Experimental Algorithmics
11.	https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1 https://online.stanford.edu/courses/soe-ycs0001-algorithms-design-and-analysis-part-2 https://in.coursera.org/specializations/algorithms
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. **(Text books)**	
1.	Tim Roughgarden, Algorithms Illuminated: Part 1: The Basics, Soundlikeyourself Publishing, September 27, 2017
2.	Tim Roughgarden, Algorithms Illuminated:Part 2: Graph Algorithms and DataStructures,Soundlike yourself Publishing, First Edition, 2018.
3.	Tim Roughgarden, Algorithms Illuminated:Part3:Greedy Algorithms and Dynamic Programming,Soundlikeyourself Publishing, First Edition, 2019.
4.	Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition**,** Pearson, 2014

CO\PO-PSO Mapping with Justification	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8-PO12	PSO1	PSO2
C106.1	**3**	**2**	**2**	**2**	**1**	**1**	**2**		**2**	
Explain complexity classes, the concept of algorithms, asymptotic analysis, and fundamental problem-solving approaches.	Strongly related to computational knowledge required to understand complexity classes and problem-solving techniques.	Moderate ability to analyze problems using algorithmic foundations.	Moderate ability to develop algorithmic solutions from problem definitions.	Moderate ability to conduct investigations and analyze algorithm efficiency	Slight connection to modern tools used for algorithm analysis.	Understanding ethical concerns in computational problem-solving.	Encourages continuous learning in algorithmic problem-solving.		Understanding algorithm complexities helps in designing efficient software solutions.	No direct link to entrepreneurship but contributes indirectly to technical problem-solving
C106.2	**2**	**3**	**2**	**2**	**2**	**1**	**2**		**3**	**2**
Apply standard algorithms to solve core problems such as sorting, searching, and graph-based challenges.	Understanding computational models helps in algorithm application.	Strong connection as problem analysis is crucial for applying algorithms effectively.	Moderate ability to transform business problems into algorithmic solutions.	Investigating algorithm efficiency is key in selecting appropriate sorting/searching techniques.	Moderate relevance in selecting tools that implement sorting/searching algorithms.	Ethical concerns in software applications that use sorting/searching techniques.	Encourages learning advanced algorithmic techniques for optimization.		Strong ability to develop software solutions using optimized algorithms.	Understanding sorting/searching algorithms contributes to software development and consulting roles.
C106.3	**3**	**3**	**3**	**3**	**2**	**1**	**2**		**3**	**2**
Evaluate and select suitable algorithm design strategies for solving specific problems.	Strong correlation with computational knowledge needed for evaluating algorithm strategies.	Strong ability to analyze algorithmic techniques and their applications	Strong ability to design efficient solutions using algorithmic design techniques.	Strong connection to conducting experiments on different algorithms for their efficiency.	Moderate relation to selecting modern tools for algorithm implementation.	Ethical considerations in choosing the best algorithmic approach.	Encourages continuous learning of evolving algorithmic techniques.		Strong ability to analyze algorithm performance for software development	Knowledge of algorithm strategies helps in research and higher education.
C106.4	**3**	**3**	**3**	**3**	**3**	**2**	**3**		**3**	**3**
Develop efficient algorithms to address and solve complex computational problems.	Strong understanding of computational principles required for developing algorithms.	Strong ability to analyze and create solutions for complex problems.	Strong ability to design innovative solutions by developing efficient algorithms.	Strong link to investigating algorithm performance and optimizing solutions.	Strong selection of modern tools to implement and optimize algorithms.	Ethics are involved in creating fair and unbiased algorithms.	Encourages lifelong learning in optimization and computational efficiency.		Strong role in developing industry-ready software solutions.	Strong relevance in entrepreneurship and research-driven projects.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	24M11CA117	**Semester: Even (specify Odd/Even)**	**Semester 2nd Month from Jan-June 2025**
Subject Name	Computer Networks		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Parmeet Kaur
	Teacher(s) (Alphabetically)	Dr. Parmeet Kaur

COURSE OUTCOMES		**COGNITIVE LEVELS**
CMAC107.1	Define the fundamental concepts of computer networking.	Remembering (Level 1)
CMAC107.2	Explain the key protocols in OSI model and TCP/IP protocol suite.	Understanding (Level 2)
CMAC107.3	Examine the functions and protocols of the application layer	Analysing (Level 4)
CMAC107.4	Compare various transport layer protocols and mechanisms to enhance their performance.	Analysing (Level 4)
CMAC107.5	Select the appropriate network and data link layer protocols based on the requirements of the communication environment.	Evaluating (Level 5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Network basics, taxonomy, Network Models, Protocol layers and their services, Connection Oriented and Connectionless services.	6
2.	The Application Layer	Principles of Protocols at Application-Layer, HTTP, DNS, Electronic Mail	6
3.	The Transport Layer	Services and Principles of Transport Layer, Multiplexing and Demultiplexing Applications, UDP and TCP, Connection Establishment, Transport Layer Protocols (go back N, stop and wait, selective repeat), Flow Control, TCP Congestion Control	12
4.	The Network Layer	Introduction, Network layer design issues, IP: the Internet IP addressing, Routing Principles, Protocols.	10
5.	The Link Layer and Local Area Networks	The Data Link Layer: Introduction, Services, Error Detection and Correction, Multiple Access Protocols and LANs, LAN Addresses and ARP, IEEE standards and Ethernet	8
Total number of Lectures			**42**
Evaluation Criteria **Components** **Maximum Marks** T1 20			

T2	20	
End Semester Examination	35	
TA	25 (Attendance = (10), Assignments/Mini-Project= (15))	
Total	**100**	

Project Based Learning: Each student in a group of 2 will choose a real-world problem such as routing, congestion control, network traffic analysis etc. for development. Simulation of the concepts at different network protocol layers relevant to the selected problem will help the students in enhancing their understanding and skills towards networking and communication related issues leading towards employability in IT and hardware sector.

Text Books	
1.	Kurose, James F., and Keith W. Ross. "Computer networking: A top-down approach edition." Addision Wesley (2007).
2.	Forouzan, Behrouz A. “Data communications and networking”. Huga Media, 2007.
Reference Books	
1.	Andrew S. Tanenbaum ,”Computer Networks “, Prentice-Hall Publishers (2003)
2.	Larry Peterson , Bruce Davie ,”Computer Networks a Systems Approach “, Morgan Kaufmann (2007)
3.	William Stallings ,”Data and Computer Communications”, Prentice Hall (2007)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CMAC107.1	1		1										1	1
	Slightly mapped as applying knowledge of domain knowledge in defined problems related to networking		Slightly mapped as Design solutions of networking are discussed											
CMAC107.2	2	2	2	2						1		1	2	1

	Moderately mapped as applying domain knowledge in study of application layer of networks protocols	Moderately mapped as analysing problems associated to application layer of networks protocols	Moderately mapped as Design solutions of application layer of networks protocols is discussed	Moderately mapped to research-based knowledge of application layer of networks protocols						Slightly mapped to complex engineering activities related to application layer of networks protocols		Slightly mapped to learning application layer of networks protocols for future	Moderately mapped as application Layer requirements are studied in order to design, develop, and test software applications using appropriate tools	Slightly mapped to research and career advancement in networking
CMAC107.3	2	2	2	2						1		1	2	1
	Moderately mapped as applying domain knowledge in study of transport layer of networks protocols	Moderately mapped as analysing problems associated to transport layer of networks protocols	Moderately mapped as Design solutions of transport layer of networks protocols is discussed	Moderately mapped to research-based knowledge of transport layer of networks protocols						Slightly mapped to complex engineering activities related to transport layer of networks protocols		Slightly mapped to learning transport layer of networks protocols for future	Moderately mapped as transport Layer requirements are studied in order to design, develop, and test software applications using appropriate tools	Slightly mapped to research and career advancement in networking
CMAC107.4	2	2	2	2						1		1	2	1
	Moderately mapped as applying domain knowledge in study of	Moderately mapped as analysing problems associated to	Moderately mapped as Design solutions of transport	Moderately mapped to research-based knowledge of transport						Slightly mapped to complex engineering activities related to transport layer of		Slightly mapped to learning transport layer	Moderately mapped as transport Layer requirements	Slightly mapped to research and career advancement

	transport layer of networks protocols	transport layer of networks protocols	layer of networks protocols is discussed	layer of networks protocols						networks protocols		of networks protocols for future	are studied in order to design, develop, and test software applications using appropriate tools	in networking
CMAC107.5	2	2	2	2						1		1	2	1
	Moderately mapped as applying domain knowledge in study of transport layer of networks protocols	Moderately mapped as analysing problems associated to transport layer of networks protocols	Moderately mapped as Design solutions of transport layer of networks protocols is discussed	Moderately mapped to research-based knowledge of transport layer of networks protocols						Slightly mapped to complex engineering activities related to transport layer of networks protocols		Slightly mapped to learning transport layer of networks protocols for future	Moderately mapped as transport Layer requirements are studied in order to design, develop, and test software applications using appropriate tools	Slightly mapped to research and career advancement in networking
NBA Code: CMAC107	1.8	2	1.8	2						1		1	1.8	1

Detailed Syllabus
Lecture-wise Breakup

Course Code	24M11CA118	**Semester Odd (specify Odd/Even)**	**Semester II Session** 2024-25 **Month from** Jan-June 2025
Course Name	Operating Systems		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Sec 62: Neetu Singh
	Teacher(s) (Alphabetically)	Sec 62: Neetu Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
CMAC108 .1	Explain the fundamental concepts and components of operating systems and system programming, and demonstrate various OS scheduling techniques and algorithms for processes and threads.	Understand Level (C2)
CMAC108 .2	Build and apply the various resource management techniques of operating systems and their performance.	Apply Level (C3)
CMAC108 .3	Demonstrate the concept of process communication and describe various techniques for synchronizing processes in an operating system.	Apply Level (C3)
CMAC108 .4	Compare various disk scheduling algorithms and utilize IO management techniques.	Analyze Level (C4)
CMAC108 .5	Choose the appropriate OS design choices when building real-world systems.	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction and Historical context of Operating Systems	What are Operating Systems? All components Description, The Evolution of OS: Batch Systems, multi programming systems, Time sharing systems, Parallel systems, Real Time systems, Distributed systems.	2
2.	Operating Structure and Architecture	Operating system structure: Micro kernel, Monolithic systems, Layered systems, Virtualization, Client-server model, Mobile Operating System. X86 architecture overview, Booting sequences, Boot loaders and their stages, BIOS and its routines, Interrupts.	2
3.	Process Concepts, Threads & Concurrency, Scheduling Concurrency & Synchronization issues,	Process concepts, Threads: Overview, Benefits, User and Kernel threads, Multithreading models. Scheduling, Operations on processes, Cooperative processes, IPC, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Process synchronization: Critical section problems, Semaphores, Synchronization hardware and monitors.	10
4.	Deadlock	System model, Characterization, Methods for handling deadlocks. Deadlock prevention, Avoidance and detection, Recovery from deadlock	5

5.	Memory Management.	Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory	8
6.	File System management and Input output management	File concept, Access models, Directory structure, Protection, File-system Structure, Allocation methods, Free space management. Overview, I/O hardware, Application I/O interface.	2
7.	Secondary Storage Management	Disk structure, Disk scheduling, Disk management., Swap-space management	2
8.	Fault and Security Issues	Overview of system security, Security methods and devices, Protection, access, and authentication, Models of protection, Memory protection.	2
9.	Distributed O. S	Int. to distributed operating systems, synchronization and deadlock in distributed systems	1
10.	Case studies of OS	Windows, Linux, IBM, Tizen Operating System	2
11.	System Programming	Introduction, Components of a Programming System: Assemblers, Loaders, Macros, Compliers, Formal System.	2
12.	Interrupts and Exceptions	Synchronous and asynchronous interrupts, Calling a System Call from User Space, INT, Trap Handling, System call dispatch, arguments and return value, Device Interrupts.	2
13.	Kernel Synchronization, System Calls and System Signals	Disabling Interrupts, Lock Implementation, Linux Synchronization Primitives	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Quiz/Assignment/Mini Project/Case Study)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Stallings, William. *Operating systems: internals and design principles*. Prentice Hall Press, 2008.
2.	Tanenbaum, Andrew S., and Albert S. Woodhull. *Operating systems: design and implementation*. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.
3.	Tanenbaum, Andrew. *Modern operating systems*. Pearson Education, Inc.,, 2009.
4.	Schilberschatz, Abraham, J. L. Peterson, and P. B. Galvin. "Operating Systems Concepts." *NC, Erewhon: Addison-Wesley Publishing Co* (1989).
5.	Gary Nutt, “Operating Systems – A modern perspective”, Pearson Education
6.	David Solomon and Mark Russinovich ,” Inside Microsoft Windows 2000”, Third Edition, Micorosoft Press

7.	D. M. Dhamdhere, " Systems Programming and Operating systems" TMH, 2nd revised edition.2006
8.	Crowley, Charles. *Operating systems: a design-oriented approach*. McGraw-Hill Professional, 1996.

Note: Faculty may use the latest research papers on the concepts of Operating Systems and system programming for better understanding and elaboration of recent trends in the market.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CMAC 108.1	**3**	**2**	**1**	**1**	**2**	**0**		**1**	**1**	**0**	**0**	**2**	**3**	**3**
	It focuses on OS fundamentals, system programming, and scheduling algorithms using computational models and mathematical foundations.	It focuses on understanding OS fundamentals, system programming, and scheduling algorithms to analyze and formulate complex computing problems.	It provides a basic understanding of OS concepts and scheduling algorithms with limited application in designing integrated solutions.	It covers OS fundamentals and scheduling algorithms with limited focus on experimental investigation and data-driven conclusions.	It provides a foundational understanding of OS concepts and scheduling techniques, with some application of modern tools and techniques for software solutions.			It covers fundamental OS concepts and scheduling algorithms, with minimal application to project management and finance in computing contexts.	It offers a foundational understanding of OS concepts and scheduling algorithms, with limited focus on communication, documentation, and presentation skills.			It fosters innovation in OS scheduling, enabling efficient process management and entrepreneurial solutions for real-world applications.	It builds the ability to analyze complex OS requirements, design efficient scheduling solutions, and develop/test software applications using appropriate methodologies and tools.	It enhances skills for careers in software development, innovation, research, and entrepreneurship by applying OS concepts and scheduling techniques to real-world problems.
CMAC 108.2	**3**	**2**	**3**	**2**	**2**	**1**		**1**	**1**	**1**	**1**	**2**	**3**	**3**
	It enables the application of computational knowledge to develop efficient resource management techniques in	It develops the ability to analyze and formulate complex OS resource management problems, applying	It enables the design of efficient resource management solutions in OS by analyzing complex scenari	It strengthens the ability to perform experiments on OS resource management techniques, analyze the	It develops the ability to select and apply modern tools and techniques for implementing OS resource manage	It encourages the application of professional ethics and adherence to cyber regulations while implementing OS		It helps understand and apply project management principles in managing OS resource management techniques, ensuring	It enhances the ability to communicate effectively about OS resource management techniques and their perfor	It fosters awareness of the economic, environmental, social, and ethical implications of applying OS resource manage	It promotes the ability to collaborate effectively in teams, applying OS resource management techniques and perform	It encourages identifying innovative opportunities in OS resource management, applying techniques to enhance system	It develops the ability to analyze complex system requirements and design, develop, and test software solution	It enhances skills for careers in software development, entrepreneurship, and research by applying OS resource manage

	operating systems, optimizing performance for diverse computing models.	appropriate techniques to enhance system performance.	os and leveraging emerging technologies for optimal performance.	results, and make informed decisions to optimize system performance.	ment solutions, enhancing system performance.	resource management techniques, ensuring responsible and efficient system performance.		efficient performance within multidisciplinary environments.	mance through clear documentation and presentations to both the computing community and society.	ment techniques, ensuring responsible professional practice.	ance improvements within a multidisciplinary environment.	performance, and creating value for both individuals and society.	s using appropriate OS resource management techniques to optimize performance.	ment techniques to improve system performance and innovation.
CMAC108.3	**3**	**3**	**1**	**3**	**2**	**1**		**1**	**1**	**1**	**1**	**2**	**3**	**3**
	It applies computational knowledge to understand and implement process communication and synchronization techniques, enabling the development of efficient computing models.	It strengthens the ability to analyze and formulate complex computing problems by applying process communication and synchronization techniques in operating systems.	It aids in addressing complex scenarios by applying process communication and synchronization techniques to propose solutions using emerging technologies.	It enhances the ability to conduct experiments on process communication and synchronization techniques, interpret data, and draw informed conclusions to improve system performance.	It helps select and apply tools for implementing process communication and synchronization in OS for innovative software solutions.	It promotes the application of professional ethics and cyber regulations while implementing process communication and synchronization techniques in operating systems.		It helps apply project management principles to manage tasks involving process communication and synchronization techniques in operating systems within multidisciplinary environments.	It improves communication of process communication and synchronization techniques through clear documentation and presentations.	It fosters awareness of the economic, social, and ethical implications of process communication and synchronization techniques in operating systems, ensuring responsible professional practice.	It promotes effective teamwork in implementing process communication and synchronization techniques within multidisciplinary environments.	It fosters innovation in process communication and synchronization techniques to create value and improve systems for societal benefit.	It develops skills for careers in software development, entrepreneurship, and research by applying process communication and synchronization techniques in operating systems.	It enhances the ability to design, develop, and test software by implementing process communication and synchronization techniques in OS.
CMAC108.4	**3**	**3**	**1**	**3**	**2**	**1**		**1**	**1**	**1**	**1**	**2**	**3**	**3**
	It uses computational knowledge to analyze and compare disk scheduling	It strengthens problem analysis by comparing disk schedul	It helps in transforming business scenarios into problems by applyin	It enhances the ability to conduct experiments and draw	It helps select tools and techniques to compare disk scheduling algorith	It promotes applying ethics and cyber regulations while compar		It helps apply project management principles to manage tasks involving disk	It improves communication of disk scheduling algorithms and	It fosters awareness of the economic, environmental, and ethical	It promotes effective teamwork in applying disk scheduling	It fosters innovation in disk scheduling and I/O management techniq	It strengthens the ability to design, develop, and test software by	It builds skills for careers in software development and entrepre

	algorithms and I/O management techniques for optimized system performance.	ing algorithms and applying I/O management techniques for optimal performance.	g disk scheduling algorithms and I/O management techniques, using emerging technologies to propose solutions.	conclusions by comparing disk scheduling algorithms and applying I/O management techniques.	ms and implement I/O management for innovative software solutions.	ing disk scheduling algorithms and using I/O management techniques globally.		scheduling algorithms and I/O management techniques in multidisciplinary environments.	I/O management techniques through effective documentation and presentations.	implications of disk scheduling algorithms and I/O management techniques in professional practice.	algorithms and I/O management techniques within multidisciplinary environments.	ues to create value and benefit society.	comparing disk scheduling algorithms and applying I/O management techniques.	neurship by applying disk scheduling and I/O management techniques.
CMAC 108.5	**3**	**3**	**1**	**3**	**2**	**1**	**1**	**1**	**1**	**0**	**2**	**2**	**3**	**3**
	It applies computational knowledge to make informed OS design choices, ensuring efficient real-world system models are developed based on mathematical foundations and computing principles.	It strengthens the ability to analyze and formulate complex computing problems by choosing appropriate OS design choices to build efficient real-world systems.	It applies OS design choices to transform business scenarios into problems and propose integrated solutions using emerging technologies.	It enhances the ability to conduct experiments, analyze data, and draw conclusions by selecting appropriate OS design choices for building efficient real-world systems.	It develops the ability to select modern tools and techniques for making appropriate OS design choices when building innovative real-world systems.	It encourages the application of professional ethics and cyber regulations while choosing appropriate OS design choices for building real-world systems in a global context.	It promotes continuous learning to stay updated with OS design choices and best practices for building real-world systems as a computing professional.	It helps apply project management principles to manage tasks involving OS design choices for real-world systems within multidisciplinary environments.	It improves the ability to communicate OS design choices effectively through documentation and presentations to both the computing community and society.		It enhances the ability to collaborate as a team member or leader in making OS design choices for real-world systems within a multidisciplinary environment.	It encourages the use of innovative OS design choices to create value and drive entrepreneurship, improving real-world systems for the betterment of individuals and society.	It enhances the ability to analyze system requirements and design, develop, and test software by selecting appropriate OS design choices for real-world systems.	It develops skills for careers in software development, entrepreneurship, and research by making informed OS design choices for building real-world systems.
Avg.	**2.5**	**2.2**	**1.2**	**2**	**1.7**	**0.7**	**0.5**	**0.8**	**0.8**	**0.5**	**0.8**	**1.7**	**2.5**	**2.5**

Computer Application
Course Description- Information Security

Course Code- 24M11CA119

NBA Code- CMAC109

Subject Code	24M11CA119	**Semester: EVEN**	**Semester** **Session** 2024 -2025 Month from: JAN to JUNE 2025
Subject Name	**Information Security**		
Credits	3-0-0	**Contact Hours**	3Hr.

Faculty (Names)	**Coordinator(s)**	Dr. Asmita Yadav
	Teacher(s) (Alphabetically)	Dr. Asmita Yadav

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Discuss the fundamental concepts of information security and malware types	Understand (C2)
CO2	Explain the security risks within an organizational context.	Understand (C2)
CO3	Demonstrate types of cryptographic techniques and working of classical cryptosystems	Apply (C3)
CO4	Determine proactive solutions to network security like Firewalls, access control and IDS	Apply (C3)
CO5	Investigate various security parameters from the perspective of legal and ethical issues	Analyze (C4)

Module No.	**Subtitle of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Information Security**	Goals of Information Security: Confidentiality, Integrity, and Availability (CIA Triad), Security Terminologies: Threats, Vulnerabilities, Risks, and Attacks	4
2.	Cryptography Concepts and	Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and	6

	Techniques	decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.	
3.	**Symmetric and Asymmetric Cryptographic Techniques**	DES, AES, Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.	6
4.	**Authentication and Digital Signatures**	Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos	6
5.	**Program Security**	Non-malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors, Salami attack, Man-in-the- middle attacks, Covert channels, , Introduction to Anti-malware technology	8
6.	**Security in Networks**	Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP,S/MIME, Access Policies, Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control, Captchas	8
7.	**Ethical, Legal, and Professional Issues**	Cybersecurity Laws and Regulations, Ethical Hacking and Penetration Testing, Privacy and Data Protection, Introduction to Cyber Crimes and Cyber Laws and IT Act 2000	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(PBL=10, Assignments =10, Attendance=5)
Total	**100**

Project Based Learning:

Each student in a group of 3-4 will select a real world application where networking and security concepts are involved. Study the literature around the chosen application. The application will be developed with the use of any open source platform and simulators in its sister lab course. This enhances the student's knowledge on secured communication applications and helps in enhancing their employability into related sector.

Recommended Reading material:

Text Books

1. "Computer Security: Principles and Practice" by William Stallings and Lawrie Brown
2. "Cryptography and Network Security" by William Stallings
3. "Hacking: The Art of Exploitation" by Jon Erickson
4. Relevant research papers and industry whitepapers
5. "Blue Team Handbook: Incident Response Edition" by Don Murdoch

Reference Books

1. "Security Engineering: A Guide to Building Dependable Distributed Systems" by Ross Anderson
2. "The Web Application Hacker's Handbook" by Dafydd Stuttard and Marcus Pinto
3. "Practical Malware Analysis" by Michael Sikorski and Andrew Honig
4. "Cybersecurity and Cyberwar: What Everyone Needs to Know" by P.W. Singer and Allan Friedman

Online Resources

1. NIST Special Publications (SP) Series
2. OWASP (Open Web Application Security Project)
3. WE (Common Weakness Enumeration)

CO-PO-PSO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CMAC109.1	3	2	2	2	1	-	1	1	1	3		1	3	
CMAC109.2	1	3	1	-	-	2	1	1	1	-	1	-		2
CMAC109.3	3	-	2	2	2	-	-	-	-	3	-	2		1
CMAC109.4	-	2	2	1	3	1	2	1	1	-	2	2	2	
CMAC109.5	1	1	-	-	-	3	1	2	3	1	2			2
NBA CODE-CMAC109	2.00	2.00	1.75	1.67	2.00	2.00	1.25	1.25	1.50	2.33	1.67	1.67	2.50	1.67

CO	PO	Justification
CMAC109.1	**PO1**	Strongly linked as it requires applying foundational computational knowledge to explain concepts.
	PO2	Moderately linked since explaining concepts involves analyzing and solving problems to some extent.
	PO3	Moderately linked as it lays the groundwork for system designs related to information security.
	PO4	Moderately linked as investigating fundamental concepts involves analytical tasks.
	PO5	Weakly linked as it has minimal reliance on modern tools at this stage.

	PO7	Weakly linked since it contributes minimally to lifelong learning.
	PO8	Weakly linked as communication of concepts may be required.
	PO9	Weakly linked since teamwork is not heavily involved.
	PO10	Strongly linked as presenting knowledge involves effective technical communication.
	PO12	Weakly linked as it indirectly encourages professional adaptability.
CMAC109.2	**PO1**	Weakly linked as identifying risks uses fundamental computational knowledge
	PO2	Strongly linked since identifying and mitigating risks involves significant problem-solving and critical thinking skills.
	PO3	Weakly linked as mitigation strategies may involve applying minimal design principles.
	PO6	Moderately linked as identifying risks must consider professional and ethical implications.
	PO7	Weakly linked since identifying and mitigating risks requires keeping updated with trends.
	PO8	Weakly linked as communication with stakeholders about risk mitigation may arise.
	PO9	Weakly linked since teamwork or collaboration in risk mitigation may be required.
	PO12	Weakly linked as it indirectly fosters adaptability in professional settings.
CMAC109.3	**PO1**	Strongly linked as understanding cryptographic techniques requires foundational computational knowledge.
	PO3	Moderately linked since it involves applying cryptographic principles in design.
	PO4	Moderately linked as investigating cryptographic solutions requires analysis.
	PO5	Moderately linked as modern tools are essential in cryptographic implementations.
	PO10	Strongly linked as technical documentation and presentations are required for cryptographic solutions.
	PO12	Moderately linked as cryptography requires adaptability to new techniques and standards.
CMAC109.4	**PO2**	Moderately linked as network vulnerabilities require problem-solving skills.
	PO3	Moderately linked since designing network security solutions involves applying core concepts.
	PO4	Weakly linked as investigative tasks are required to identify security solutions.
	PO5	Strongly linked since modern tools like Firewalls and IDS are vital to network security solutions
	PO6	Weakly linked as proactive solutions must adhere to professional and ethical standards
	PO7	Moderately linked as staying updated with network security threats is necessary for lifelong learning.
	PO8	Weakly linked as effective communication of solutions to stakeholders may be needed
	PO9	Weakly linked since collaboration in implementing network security is involved.
	PO11	Moderately linked as applying network security solutions involves teamwork and project alignment.

	PO12	Moderately linked as network security requires continual learning and adaptation to new threats.
CMAC109.5	**PO1**	Weakly linked as evaluating security parameters involves limited computational knowledge.
	PO2	Weakly linked as problem-solving is minimally required for analyzing legal and ethical issues
	PO6	Strongly linked as legal and ethical issues are crucial to professional and societal contexts.
	PO7	Weakly linked since addressing ethical issues indirectly fosters lifelong learning.
	PO8	Moderately linked as effective communication is essential for discussing legal and ethical matters.
	PO9	Strongly linked as teamwork is often involved in resolving ethical and legal issues.
	PO11	Moderately linked as addressing ethical issues aligns with team projects and professional responsibilities.

Detailed Syllabus
Lecture-wise Breakup

Course Code **NBA Code**	24M12CA111	**Semester: Even 2025** **(Specify:)**	**Semester: Even 2025** **Session: January- June 2025** **Months: 6**
Course Name	Cloud computing and Deployment		
Credits	**3-0-0**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr Sandeep Kumar Singh
	Teacher(s) (Alphabetically)	Dr Sandeep Kumar Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO 1	Explain the basic concepts of cloud computing, service models, deployment models, and AWS global infrastructure.	Understand (Level 2)
CO 2	Demonstrate the ability to deploy and manage AWS compute and storage services like EC2, S3, EBS, and EFS.	Apply (Level 3)
CO 3	Achieve secure and scalable networking solutions, including VPC, IAM, and security groups.	Analyze (Level 4)
CO 4	Assess and optimize AWS services for cost-efficiency and performance using tools like CloudWatch, CloudTrail, and AWS Cost Explorer.	Evaluate (Level 5)
CO 5	Design and deploy serverless architectures and applications using AWS Lambda, API Gateway, and Elastic Beanstalk.	Create (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Cloud Computing and AWS Fundamentals	Definition, Characteristics, Benefits, Cloud Computing Models.Overview of Leading Cloud Providers: AWS, Azure, Google Cloud, AWS Regions, Availability Zones, and Edge Locations. Public, Private, and Hybrid Cloud Deployment Models Examples on AWS.	4
2.	Virtualization and Role in Cloud Computing	Introduction to Virtualization: Concepts, Benefits, and Types, Virtual Machines vs. Containers: Key Differences and Applications, Hypervisors: Types and Role in Virtualization	3
3.	Core AWS Compute and Storage Services	EC2 Instance Types, Key Features, and Pricing Models. S3, EBS, and EFS Features and Attaching and Managing EBS Volumes.	6
4.	Networking Essentials in AWS	Virtual Private Cloud (VPC) Basics, Subnets, Route Tables, Internet Gateways, and NAT Gateways, ELB Types, Auto Scaling Policies, and Benefits.	4

5.	Security and Access Management in AWS	IAM Users, Roles, Policies, and Groups. Multi-Factor Authentication and Least Privilege Access..	4
6.	Databases and Analytics on AWS	RDS Features, Multi-AZ Deployment, and Backup, DynamoDB Features and Use Cases.	3
7	Serverless Architectures and AWS Lambda	Introduction to Containers and Docker: Basics and Use Cases, Kubernetes: Architecture, Components, and Use Cases, Deploying Applications Using Kubernetes,Containerized Application Deployment Using Amazon ECS and EKS, Elastic Beanstalk Features and Deployment Models, Docker, ECS, and Kubernetes, AWS Lambda: Introduction to Serverless Computing , Serverless Computing and Event-Driven Architectures, API Gateway Features and REST API Configuration	10
8.	Cloud Monitoring and Cost Management	AWS Cloud Watch, Metrics, Alarms, Dashboards, and Logs, Cost Explorer, Budgets, and Cost Optimization Strategies, AWS CloudTrail: Tracking API Calls and Activity	4
9.	Advanced AWS Services and Concepts	AWS CloudFormation Basics, Shared Responsibility Model, Encryption Using AWS Key Management Service (KMS), AWS CloudFormation: Automating Infrastructure Deployment.	4
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (PBL-Attendance/Assignment)
Total	**100**

Project Based Learning: A PBL Project on Developing and Deploying Application on public cloud provider.

Recommended Reading material:

1.	Charles Badcock, “Cloud Revolution” , TMH
2.	Dan Sanderson- O’Reilly, “Programming Google App Engine”, Google Press: (ISBN-978-0- 596-52272-8)
3.	Anthony T. Vetle “Cloud Computing: A practical approach” Tata McGraw Hill Education Private Limited (2009
4	Kris Jamsa- Jones & Bartlett Learning, “Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More” (Student Edition)

Text Books

1.	Kailash Jayaswal, Jagannath Kallakurchi, Donald J Houde, Dr. Deven Shah, “Cloud Computing: Black Book”, Dreamtech Publications (ISBN 978-93-5119- 418-7)

2.	Ronald L. Krutz, Russell Dean Vines, “Cloud Security A comprehensive Guide to secure Cloud Computing” Wiley.
3.	Rishabh Sharma . “Cloud Computing Fundamentals, Industry Approach and Trends”, Wiley Publication.(ISBN: 978-81-265-5306-8)

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	3	2	2				2				2	1
CO2	2	2	3	3	3				2				3	2
CO3	2	3	3	3	2				2				3	2
CO4	2	3	3	3	3				3				3	3
CO5	3	3	3	3	3				3	3	3	2	3	3

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	This will moderately contribute to Computational knowledge	This will moderately contribute to Problem analysis through PBL	This will strongly contribute to Design and Development of PBL Solution	This will moderately contribute to iin devising solutions, conducting experiments	This will moderately contribute to exploring different AWS Services and tools				This will moderately contribute to improving Communication skills				This will moderately contribute to analyze complex requirements, design, build and deploy cloud based solutions through PBL	This will slightly contribute to building their career paths
CO2	This will moderately contribute to Computational knowledge	This will moderately contribute to Problem analysis through PBL	This will strongly contribute to Design and Development of PBL Solution	This will strongly contribute to iin devising solutions, conducting experiments	This will strongly contribute to exploring different AWS Services and tools				This will moderately contribute to improving Communication skills				This will strongly contribute to analyze complex requirements, design, build and deploy cloud based solutions through PBL	This will moderately contribute to building their career paths
CO	This will moderately	This will strongl	This will strongly contribu	This will strongly contrib	This will moder				This will moder				This will strongly contribute	This will moder

3	contribute to Computational knowledge	y contribute to Problem analysis through PBL	te to Design and Development of PBL Solution	ute to iin devising solutions, conducting experiments	ately contribute to exploring different AWS Services and tools				ately contribute to improving Communication skills				to analyze complex requirements, design, build and deploy cloud based solutions through PBL	ately contribute to building their career paths
CO4	This will moderately contribute to Computational knowledge	This will strongly contribute to Problem analysis through PBL	This will strongly contribute to Design and Development of PBL Solution	This will strongly contribute to iin devising solutions, conducting experiments	This will strongly contribute to exploring different AWS Services and tools				This will strongly contribute to improving Communication skills				This will strongly contribute to analyze complex requirements, design, build and deploy cloud based solutions through PBL	This will strongly contribute to building their career paths
CO5	This will strongly contribute to Computational knowledge	This will strongly contribute to Problem analysis through PBL	This will strongly contribute to Design and Development of PBL Solution	This will strongly contribute to iin devising solutions, conducting experiments	This will strongly contribute to exploring different AWS Services and tools				This will strongly contribute to improving Communication skills	This will strongly contribute to developing solutions through PBL project which are of societal concerns	This will strongly contribute to building team work and polish individual capabilities	This will moderately contribute to imbibing innovative solutions and drive their entrepreneurial skills	This will strongly contribute to analyze complex requirements, design, build and deploy cloud based solutions through PBL	This will strongly contribute to building their career paths

Detailed Syllabus
Lecture-wise Breakup

Subject Code	24M15CA116 NBA Code: **CMAC155**	**Semester: EVEN**	**Semester: 1st Session: 2024-2025** **Month: Jan- June 2025**
Subject Name	Design and Analysis of Algorithms Lab		
Credits	**0-0-1**	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Aakriti Bhardwaj
	Teacher(s) **(Alphabetically)**	Aakriti Bhardwaj, Ayush Sahu, Shelendra Pal

COURSE OUTCOMES		**COGNITIVE LEVELS**
CMAC155.1	Apply fundamental algorithmic techniques like divide-and-conquer, greedy, and dynamic programming.	Apply (Level 3)
CMAC155.2	Analyze the time and space complexity of algorithms and compare their efficiency using asymptotic analysis.	Analyze (Level 4)
CMAC155.3	Analyze time and space complexities and compare algorithm efficiency.	Analyze (Level 4)
CMAC155.4	Evaluate algorithmic solutions using advanced techniques like backtracking and network flow.	Evaluate (Level 5)
CMAC155.5	Create optimized algorithms for real-world problem-solving.	Create (Level 6)

Lab-Wise Breakup for DAA

Module No.	Module Title	Topics Covered in module	No. of Labs for the module
1	Introduction	Fundamentals of algorithms, asymptotic notations, time and space analysis.	2
2	Divide and Conquer	Recurrence relations, binary search, merge sort, quicksort, and heap sort. Strassen's matrix multiplication	2
3	Greedy Algorithms	Knapsack problem, Job sequencing with Deadlines, Dijkstra's algorithm. Fractional and 0/1 Knapsack; Coinage problem	2
4	Backtracking	4/8 Queen's problem, Graph Coloring, 0/1 Knapsack, Traveling Salesman Problem (TSP)	2
5	Dynamic	0/1 knapsack, coin change, all-pairs shortest	2

	Programming (DP)	paths, matrix chain multiplication. Longest common subsequence, string editing, longest increasing sequence.	
6	Problem Spaces and Problem-solving by search	tic-tac-toe, hill climbing, A* algorithm, Maximum flow algorithms: DFS, BFS	2
7	String Algorithms	Brute force pattern matching, KMP, Rabin-Karp, suffix trees and arrays.	1
8	Project-based Learning	Mini-project involving a combination of DAA techniques.	1

Total number of Labs	**14**

Evaluation Criteria		
Components	**Maximum Marks**	
Eval 1	15	
Eval 2	15	
Lab Test 1	20	
Lab Test 2	20	
PBL	15 (Students will submit the mini project in a group of 3-4 members)	
Attendance	15	
Total	**100**	

Project based learning: Create a Java application in groups of maximum 4 students each, to illustrate the concepts covered in lab.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. **(Reference Books,** Journals, Reports, Websites etc. in the IEEE format)	
1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, MIT Press, 3rd Edition, 2009
2.	Steven Skiena,The Algorithm Design Manual, Springer; 2nd edition, 2008
3.	Knuth, The art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional; 3rd edition,1997
4.	https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1 https://online.stanford.edu/courses/soe-ycs0001-algorithms-design-and-analysis-part-2 https://in.coursera.org/specializations/algorithms
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. **(Text books)**	

1.	Tim Rough garden, Algorithms Illuminated: Part3:Greedy Algorithms and Dynamic Programming,Sound like yourself Publishing, First Edition, 2019.
2.	Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition**,** Pearson, 2014

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
	Text Books
1	Herbert Shildt: *Java: The Complete Reference*, 12th Edition, McGraw-Hill, 2021.
2	Y. Daniel Liang: *Intro to Java Programming, Comprehensive Version*, 10th Edition, Pearson, 2018.
Reference Books	
1	Kathy Sierra, Bert Bares & Trisha Gee: *Head First Java,* 3rd Edition, O'Reilly Media, 2022.
2	Paul Deitel and Harvey Deitel: *Java: How to Program, Late Objects*, 11th Edition, Pearson, 2021.

VISION

To become a centre of excellence to produce skilled applied computing professionals, who not only possess sound theoretical knowledge but also have a rigorous hands-on experience, to lead, innovate, venture in entrepreneurship, adapt to evolving technologies, and make a positive and effective contribution to the society.

MISSION OF DEPT. OF COMPUTER APPLICATIONS

MISSION 1: To inculcate sound theoretical knowledge, practical experience, ethical values and professionalism through futuristic curriculum.

MISSION 2: To conduct activities for developing competencies for innovation, entrepreneurship, research and pursuing higher education.

MISSION 3: To empower individuals with practical experience in cutting-edge tools and technologies to create computer applications addressing societal and industrial needs.

PROGRAM NAME: MCA (MASTER'S OF COMPUTER APPLICATIONS)

PROGRAM OUTCOMES(POs)

PO1. Computational Knowledge: Understand and apply mathematical foundation, computing and domain knowledge for the conceptualization of computing models from defined problems.
PO2. Problem Analysis: Ability to identify, critically analyse and formulate complex computing problems using fundamentals of computer science and application domains.
PO3. Design / Development of Solutions: Ability to transform complex business scenarios and contemporary issues into problems, investigate, understand and propose integrated solutions using emerging technologies
PO4. Conduct Investigations of Complex Computing Problems: Ability to devise and conduct experiments, interpret data and provide well informed conclusions.

PO5. Modern Tool Usage: Ability to select modern computing tools, skills and techniques necessary for innovative software solutions
PO6. Professional Ethics: Ability to apply and commit professional ethics and cyber regulations in a global economic environment.
PO7. **Life-long Learning**: Recognize the need for and develop the ability to engage in continuous learning as a Computing professional.
PO8. Project Management and Finance: Ability to understand, management and computing principles with computing knowledge to manage projects in multidisciplinary environments.
PO9. Communication Efficacy: Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations.
PO10. **Societal & Environmental Concern:** Ability to recognize economic, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.
PO11. Individual & Team Work: Ability to work as a member or leader in diverse teams in multidisciplinary environment.
PO12. Innovation and Entrepreneurship: Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

PROGRAM NAME: MCA (MASTER'S OF COMPUTER APPLICATIONS)

PROGRAM SPECIFIC OUTCOMES(PSO)

PSO1: To develop ability to analyze complex system requirements in order to design, develop, and test software applications using appropriate programming languages, frameworks, tools, and methodologies.
PSO2: To develop skills to embark on careers as entrepreneurs, innovators, software developers, consultants or pursue interest in teaching, research and development or higher education

CO-PO-PSO MAPPING

	PO 1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	2	2	3				1	1	1	2	3	2
	Computational understanding of algorithms	Algorithm techniques aid problem formulation	Algorithms enable efficient solution design	Algorithms used for problem investigation.	optimize modern computational tools				Limited impact on ethical considerations.	Minimal contribution to communication skills.	Limited contribution to team work skills.	Moderate contribution to lifelong learning.	Algorithms crucial for advanced problem-solving.	Algorithms support developing algorithmic expertise
CO2	3	3	2	3	2				1	1	1	1	3	2
	Strong alignment with engineering knowled	Strong problem analysis capabilities.	Moderate design and solution development.	Strong problem investigation and understanding	Moderate tool usage relevance.				Minimal contribution to societal impact.	Minimal communication-related contributions.	Minimal leadership or team work contribution.	Minimal lifelong learning contribution.	Strong problem-solving capability enhancement.	Moderate development of algorithmic expertise.

	ge													
CO3	3	3	2	3	2				1	1	1	1	3	2
	Strong algorithmic and engineering knowledge.	Strong problem analysis skills.	Moderate solution design development.	Strong problem investigation techniques.	Moderate tool usage impact.				Minimal societal or ethical impact.	Minimal communication-related impact.	Minimal team work or leadership impact.	Minimal contribution to lifelong learning.	Strong problem-solving capability development.	Moderate algorithmic expertise growth.
CO4	3	3	3	3	3				2	2	2	2	3	3
	Strong alignment with engineering knowledge.	Strong problem analysis and formulation.	Strong design and solution development	Strong investigation of complex problems.	Strong relevance to modern tool usage.				Moderate societal or ethical impact.	Moderate communication and documentation skills.	Moderate leadership or team work development.	Moderate lifelong learning development.	Strong enhancement of problem-solving skills.	Strong growth in algorithmic expertise
CO5	3	3	3	3	3				2	2	2	3	3	3
	understanding of engineering concepts	Strong ability to analyze and breakdown problems.	Strong solution development.	Strong problem investigation	Strong tool usage				Moderate contribution on Minimal societal impact but applicable in real-world systems.	Basic communication of algorithm design.	Moderate contribution to team work and leadership.	Strong lifelong learning development	Strong problem-solving ability	Strong algorithmic expertise.
AVG	3	3	2.4	2.8	2.6				1.4	1.4	1.4	1.8	3	2.4

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	-	-	-	1	1	1	2	3	2
Co2	3	3	2	3	2	-	-	-	1	1	1	1	3	2
Co3	3	3	2	3	2	-	-	-	1	1	1	1	3	2
Co4	3	3	3	3	3	-	-	-	2	2	2	2	3	3
Co5	3	3	3	3	3	-	-	-	2	2	2	3	3	3
AV	3	3	2.4	2.8	2.6	-	-	-	1.4	1.4	1.4	1.8	3	2.4

G													

Course Objectives: Computer Network Lab (24M15CA117)

DetailedSyllabus

SubjectCode	24M15CA117	**Semester: Even (specify Odd/Even)**	**Semester2nd MonthfromJan-June2025**
SubjectName	ComputerNetworksLab		
Credits	3	**ContactHours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Mr Prateek Kumar Soni
	Teacher(s) (Alphabetically)	Prof. Parmeet Kaur, Mr Prateek Kumar Soni

S.No.	DESCRIPTION	COGNITIVE LEVEL (BLOO MS TEXONOMY)
CO 1	Describe all the wired/wireless technologies and the basic network building blocks	UnderstandLevel (Level 2)
CO2	Apply concepts of networking for the data packets of different TCP/IP layers. Store the data packets as *.pcap files.	Apply Level (Level 3)
CO 3	Analyze various aspects of client and server applications using the"Sockets"at Data linkand TCP layer.	Analyze Level (Level 4)
CO4	Analyse routing algorithms (e.g., Link State, Distance Vector Routing) for network efficiency	Analyze Level (Level 4)
CO5	Analyse trace files using scripts like AWK for data visualization based on NS2 simulator.	Analyze Level (Level 4)

Module No.	Subtitleofthe Module	Topics in themodule	CO

1.	**Introduction**	Introduction to Computer Network devices / UNIX Commands for TCP/IP Protocol	**CO.** 1
2.	**Wireshark Simulator**	Practice on WIRESHARK with tcp dump :Application Layer ,Transport	**CO.** 2
3	**SocketProgramming**	Client server programming using TCP and UDP, Implementing a calculator	**CO3**
4	**NetworkSimulator (NS2)**	Network simulation models , X-Graph Generation using AWK Script & Trace file Analysis,	**CO4**
5	**Simulationusing NS-2 simulator based on UbuntuLinuxdesktop**	Routing packets in Network, Routing strategies in NS2(Static, Session, Dynamic, Manual)	**CO5**

EvaluationCriteria

Components

MaximumMarks Lab Test -1	**20**
LabTest-2	**20**
LabEvaluations	**30**
Project	**20**
Attendance	**10**
Total	**100**

Project based learning :Each student in a group of 4-5 will select an application and analyzethedifferentlayersofthenetworkmodelandhowdataflowsthrougheachin order to make subject application based. Understanding the various challenges and problems related to sustainable development, like energy and waste management, water conservation, smart cities, smart agriculture helps in determining the major requirements of the communication sector .This enhances the student's knowledge on of new world data applications and helpsin enhancing their employability into related sector.

1.	James F. Kurose, KeithW. Ross, " Computer Networking : A Top-Down Approach Featuring the Internet " 3rd Edition Pearson Education.
2.	Andrew S .Tanenbaum,"Computer Networks"4thEdition
3.	UNIX Network Programming, Volume 1, Second Edition: Networking APIs: Sockets and XTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
4.	Teerawat Issariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer.
5.	Anishnath,"PacketAnalysiswithWiresharkPaperback,"PacktPublishing
6.	YoramOrzach,"NetworkAnalysisUsingWiresharkCookbook,"PacktPublishing
7	https://www.arduino.cc/en/Tutorial/HomePage
8	https://www.raspberrypi.org/documentation/
9	https://www.dragino.com/downloads/

CourseDescription:

Wireshark Tool: Introduction to packet sniffing, Installation of Wireshark, Wireshark Acrhitecture, Packet Capturing, Analysis of packets at different layers.

Socket Programming: Basics of socket programming (TCP, UDP, SMTP, ICMP) in python, creating a socket ,binding sockets to specific address and por t,send and receive a HTTP packet.

SimulationusingNS-2simulator based on Ubuntu Linux desktop: Introduction about NS2, Installation Procedure, NS2 Architecture and Components, TCL Scripting / OTCL (creating and reading the trace file), Network Simulation models, X-Graph Generation using AWK Script & Trace file Analysis, Routing packets in Network, Routing strategies in NS2(Static, Session, Dynamic, Manual)

Routing Algorithms: Implementation of Routing Algorithms (Link State Routing, Distance Vector Routing)

CO-PO and CO-PSO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	1							1	1	3	2	1
CO 2	2	1	3	2					1				3	1
CO 3	2	2	3	1	2					3	3	2	2	3
CO 4	3	3	1	2					1	1	1	3	1	2
CO 5	3	3	2		2					2	2	2	3	3
	3	2	2	1	1				0	1	1	2	2	2

CO-PO and CO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1. Understanding network technologies and basic network components.	2Identifying and understanding network technologies and components.	**1**: understanding wired/wireless technology enable in solving engineering problem			.				**1** Describe network technologies, communicate effectively with society.	**1** Describe network technologies, apply project management principles effectively.	**3** analyze network technologies, engage in lifelong learning.	**2** identify network technologies, recognize need for lifelong learning.	**1** Describe network technologies, excel in programming competitions.
CO2	**2** Identifying networking concepts for data packets storage.	1 understanding data packets in different TCP/IP layers.	**3** Analysis Store TCP/IP packets and design solutions with impact.	**2** identified networking concepts, store packets, investigate complex problems.				.	**1 understanding** Communicate networking concepts effectively through documentation and presentations.				**3** : Analyze networking concepts, identify suitable data structures and algorithms.	**1** understanding networking concepts, excel in programming challenges and competitions.
CO3	2 identifying client-server applications at transport and data-**link.**	2 identifying client-server applications using socket programming concepts.	**3** Analyze client-server applications with sockets, design impactful solutions.	**1** understanding client-server applications with sockets, investigate complex problems.	**2**identify client-server applications with sockets, apply modern tools.					**3** Analyze client-server applications, communicate effectively on engineering activities.	**3** Analyze client-server applications, apply project management principles effectively.	**2** identified client-server applications, engage in lifelong learning.	**2** identify client-server applications, identify suitable data structures and algorithms.	**3**Analyze client-server applications, excel in programming competitions and challenges.
C	3 Anal	3	**1** understanding	**2** identified				.	**1** understanding	**1** understand	**1** understand	**3** Analyze	**1** understand	**2** identified

O 4	ysing routing algorithms for network efficiency improvement.	Analysing comparing various network routing algorithms.	routing algorithms and design solutions with impact.	routing algorithms, investigate network efficiency and problems.					Communicate routing algorithm analysis effectively through documentation and presentations.	routing algorithms, communicate effectively on network efficiency.	routing algorithms, apply project management principles effectively.	routing algorithms, engage in lifelong learning.	routing algorithms, identify suitable data structures and algorithms.	routing algorithms, excel in programming challenges and competitions.
CO 5	3 Analysing trace files using AWK for visualization.	3 analysing trace files for network simulation analysis	**2** identified trace files with AWK, design impactful solutions.		**2** identify trace files with AWK, apply modern tools.	.				**2** identified trace files, communicate findings effectively to stakeholders.	**2** identified trace files, apply project management principles effectively.	**2** identified trace files, engage in lifelong learning and improvement.	**3** Analyze trace files, identify suitable data structures and algorithms.	**3** Analyze trace files, excel in programming challenges and competitions.
	3	**2**	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**2**	**2**	**2**

Detailed Syllabus
Lab-wise Breakup

Subject Code	24M15CA118	**Semester Even**	**Semester** I **Session** 2024-2025 **Month: Jan-July**
Subject Name	Operating System Lab		NBA Code: **CMAC157**
Credits	0-0-1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Deepika Varshney
	Teacher(s) (Alphabetically)	Deepika Varshney, Jyoti

COURSE OUTCOMES		**COGNITIVE LEVELS**
CMAC157.1	Demonstration of Various Unix Commands.	Understand Level (Level 2)
CMAC157.2	Develop programs to create different types of processes under Linux environment.	Apply Level (Level 3)
CMAC157.3	Develop programs to implement resource management task like CPU scheduling algorithms, deadlock handling.	Apply Level (Level 3)
CMAC157.4	Develop programs to implement and test various synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites.	Apply Level (Level 3)
CMAC157.5	Examine the various disk-scheduling algorithms, memory management schemes, file management systems.	Analyze Level (Level 4)

Module No.	**Topic**	**No. of Labs**	**COs**
1.	Unix Commands	1	**CO1**
2.	Process creation/ Inter process communication (IPC)	2	**CO2**
3.	Synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites.	2	**CO4**
4.	Resource management task like CPU scheduling algorithms, deadlock handling.	3	**CO3**
5.	Disk-scheduling algorithms, memory management schemes, file management systems.	2	**CO5**

Evaluation Criteria

Components	**Maximum Marks**
Lab Test-1	**20**
Lab Test-2	**20**
Day-to-Day	**60**(Mini Project-20, Lab Assessment-30, Attendance-10)
Total	**100**

Project Based Learning: Project based learning: Each student works on different case studies in Lab Assignments. They utilize the concepts taught in the lab and develop projects in a group of 3-4. The course emphasized on the skill development for employability in software industry by engaging students on soft development methodologies

of operating systems. Various activities are carried out to enhance the student's software development skills. Some of them are study of various scheduling methods, memory management techniques and file management techniques.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc.)	
Text book(s)	
1.	CharlesCrowley "Operating System A Design Approach"TMH.
2.	Andrew S. Tanenbaum "Operating Systems Design and Implementation", Third Edition,Prentice Hall Publications 2006
3.	A.S. Tanenbaum, "Modern Operating Systems", 2nd edition, Prentice Hall India.
4.	A.Silberschatz, P.Galvin, G. Gagne, "Operating systems concepts" Willey international company (Ninth edition)
Reference Book(s)	
5.	Gary Nutt, "Operating Systems – A modern perspective", Pearson Education
6.	David Solomon and Mark Russinovich, "Inside Microsoft Windows 2000", Third Edition, Micorosoft Press
7.	Milan Milenkovic, "Operating Systems: Concepts and Design", McGraw-Hill computer science series
8.	ACM/IEEE transactions on operating systems concepts.
9.	www.vmware.com

	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PS O2**
CMA C157. 1	**1**	**2**	**1**	**1**	**1**								**2**	**2**
	Slightly related to the application knowledge of engineering problems	Moderately related to principles of problem analysis.	Slightly Mapped as understanding of fundamentals of the system components.	Slightly Mapped as analysis of fundamentals of the system components.	Slightly Mapped as using tools and commands for modeling problems.								Moderately Mapped as understanding of fundamentals of research problems	Moderately Mapped as understanding of basics of system structures to develop real world projects and solutions
CMA C157. 2	**3**	**2**	**3**	**2**	**2**					**2**	**1**	**1**	**3**	**3**

	Strongly Mapped as applying various approaches for multiprocessing in different real world applications	Moderately Mapped in identifying and analyzing differentprocesses for different problems	Strongly Mapped designing and developing solutions using pthread library under linux environment	Moderately Mapped to analyzing and interpreting real world problems and synthesizing solutions using multiprocessing.	Moderately Mapped to using linux environment and simulating multiple processes representing different application.					Moderately Mapped as students will communicate interpretability in course project	Slightly Mapped as students will be able to manage their course project	Slightly Mapped as interpretation of applicability of multiprocessing will help in adapting to technological solutions	Strongly Mapped as identifying suitable algorithms to develop real world applications using multiprocessing approaches	Strongly Mapped as interpretation of applicability of multiprocessing models help in programming competitions.
CMAC157.3	**3**	**3**	**3**	**2**	**2**					**2**	**1**	**1**	**3**	**3**
	Strongly Mapped as implementing various approaches for resource management tasks.	Strongly Mapped in identifying and analyzing resource management issues and requirements.	Strongly Mapped designing and developing solutions to implement CPU scheduling and deadlock handling.	Moderately Mapped to investigate and address complex issues related to resource management.	Moderately Mapped to utilize software tools and techniques for developing and testing resource management programs.					Moderately Mapped as students will communicate interpretability in course project	Slightly Mapped as manages resources efficiently during the development of resource management programs	Slightly Mapped as interpretation of applicability of knowledge and skills in the field of resource management.	Strongly Mapped as identifying programs for resource management to develop CPU scheduling and deadlock handling algorithms	Slightly Mapped as interpretation of applicability of Topic modeling techniques in NLP applications to help in programming competitions.
CMAC157.4	**3**	**3**	**3**	**2**	**2**					**2**	**1**	**1**	**3**	**3**
	Strongly Mapped as developing programs to	Strongly Mapped in analyzing synchr	Strongly Mapped in designing and develo	Moderately Mappe	Moderately Mapped to modeling and					Moderately mapped in Communicating the design, implemen	Slightly Mapped in Managing resources efficientl	Slightly Mapped as updating knowledge and skills in	Strongly Mapped as developing various synchronization techniques,	Strongly Mapped as Demonstrating problem-solving skills by analyzing and addressing synchronization

	demonstrate a deep understanding of concurrency and synchronization concepts.	onization problems in concurrent systems and apply appropriate techniques to address them effectively.	ping software solutions that implement synchronization techniques, to ensure correct and efficient concurrent operation.	d to investigate and resolve complex synchronization issues in concurrent systems.	classifying text using supervised and unsupervised techniques for NLP applications					tation, and testing results of synchronization programs clearly and effectively.	y during the development and testing of synchronization program.	the field of concurrency, synchronization, and testing techniques.	using appropriate programming languages and tools.	challenges in concurrent systems using classical test suites.
CMAC157.5	**3**	**3**	**3**	**2**	**2**					**2**	**1**	**1**	**3**	**3**
	Strongly Mapped as Understanding and applying various disk-scheduling algorithms, memory management schemes, and file management systems, demonstrating a strong foundation in CS concepts.	Strongly Mapped in Analyzing and evaluating the performance of different algorithms, schemes, and management systems to make informed decisions and optimizations.	Strongly Mapped in Applying critical thinking skills to identify the strengths and weaknesses of different algorithms and schemes, enabling the selection of the most suitable solutions for specific scenarios.	Moderately Mapped to Co-designing these components involving creative thinking and innovation to develop efficient and effective solutions.	Moderately Mapped to Effectively communicate the results of the analysis and design to both technical and non-technical stakeholders, making complex concepts understandable.					Moderately Mapped as students will communicate interpretability in course project	Slightly mapped to applying skills learned in the analysis and design of these components to contribute to entrepreneurial endeavors or manage technology projects effectively.	Slightly mapped as interpretation of potential societal benefits and concerns associated with scheduling algorithms, management schemes, and systems, and work towards addressing them.	Strongly Mapped as Applying core knowledge of computer science and engineering to design and analyze scheduling algorithms, management schemes, and systems effectively.	Strongly Mapped as interpretation of problem-solving skills by analyzing and optimizing the performance of various system components.
NBA Code: CMAC157	3	3	3	2	2					2	1	1	3	3

Detailed Syllabus

Course Code	24M15CA119	**Semester** Even **(specify Odd/Even)**	**Semester 2nd Session** 2024 -2025 **Months from** Jan 2025 **to** May 2025
Course Name	Information Security Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	J62: Dr. Aastha Maheshwari
	Teacher(s) (Alphabetically)	J-62: Dr. Aastha Maheshwari, Dr. Asmita Yadav

Course Outcomes (CO)	**Description**	**Cognitive Level (Bloom's Taxonomy)**
C374.1	Describe and explain the different cipher techniques and understand various anti-virus and anti-worms	Level-2 (Understanding Level)
C374.2	Construct and make a code to implement various Symmetric key, Asymmetric key cryptographic techniques and steganography techniques	Level-3 (Applying Level)
C374.3	Apply a client server programming for symmetric, asymmetric algorithms and key exchange algorithms, Application of information security to real world problems	Level-3 (Applying Level))
C374.4	Examine and analyze the packet information for different protocols using Wireshark.	Level-4 (Analyzing Level)

CO-PO and CO-PSO Mapping:

(COs) / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	1		1		3	2		2	2		1	1	2	2
	Strong alignment with engineering knowledge in cryptography.		Focuses more on understanding than solution design.		Requires modern cryptographic tools.	Security technologies impact societal well-being.		Ethics are considered but not a core focus.	Some collaboration in labs.		No focus on project management or finance.	Encourages continued learning, though not the main focus.	it provides foundational knowledge relevant to security design,	it provides theoretical knowledge that can be applied in careers related to software development and security.
CO2	3	1	2	1	2	3		1	2		1	2	2	2
	Strong alignment with cryptographic engineering knowledge.	Cryptographic techniques require problem analysis.	Requires design and implementation of cryptographic	Involves problem-solving to implement	Strong use of modern tools for cryptographic coding.	Cryptography has social implications but not a core	Limited connection to environmental sustainability.	Ethics not explicitly addressed in the course	Collaboration is important, especially in group coding	Medium emphasis on communication, but coding is the main	Project management aspects are secondary.	Involves lifelong learning as cryptography evolves	it emphasizes programming	it provides important skills for software development and could

(COs) / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
			solutions.	complex techniques.		focus.		.	tasks.	task.		.	and technical implementation of cryptographic techniques,	indirectly support innovation or consulting in the security field.
CO3	3		3	1	2	2		2		2	1	2	2	2
	Strong alignment due to cryptographic knowledge and client-server concepts.	Real-world application requires solving security problems.	Designing secure systems in client-server models requires deep knowledge.	Less focus on investigation, more on application.	Uses modern programming tools for implementing cryptography.	Cryptography impacts privacy and societal security.	Cryptography has societal implications but not an explicit focus.	Ethics considered in secure systems, but not the core focus.	Can be done individually or in teams for system development.	Communication is critical when working on security systems.	No focus on financial or managerial aspects.	Lifelong learning is necessary for staying updated with security technologies.	it involves programming and system design in a client-server context	it offers practical skills for software development and problem-solving, which can contribute to entrepreneurial careers in the tech industry.
CO4	2		2	1	2	2		1		2	1	2	2	2
	Medium alignment with engineering knowledge in packet analysis.	Involves investigating network traffic and identifying issues.	Focuses on analysis rather than developing network solutions.	Involves investigating complex traffic patterns and network protocols.	Strong use of Wireshark and other tools for packet analysis.	Network analysis has societal relevance but not an explicit focus.	Environmental sustainability is not addressed directly.	Ethical issues in network traffic analysis aren't the core focus.	Analysis can be done individually or in teams.	Communication of findings is necessary but not the primary focus.	Project management or financial aspects are not a focus.	Lifelong learning is encouraged due to evolving networking protocols.	it enhances understanding of network security	it provides valuable skills for network security careers, which can indirectly support entrepreneurship or

(COs) / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
														consulting,

Module No.	Title of the Module	List of Experiments
1.	Cryptography	Introduction to Cryptography
2.	Ciphers	Implementation of Cipher using Transposition techniques and Caesar Cipher
3.	Ciphers	Implementation of Substitution Ciphers: Hill Cipher and Polyalphabetic Cipher
4.	Symmetric key cryptography	Introduction to Symmetric key cryptography
5.	Data Encryption Standard	Implementation of Data Encryption Standard (DES)
6.	Public key cryptography	Introduction to Public key cryptography and Digital signature
7.	Key Exchange Algorithm	Implementation of Diffie Hellman Key Exchange Algorithm
8.	Client server programming	Client server programming using TCP
9.	Client server programming	Implementation of DES and RSA using Client server programming
10.	Steganography	Introduction to Steganography
11.	Antivirus and Anti-Worms	Introduction to Antivirus and Anti-Worms, and Wireshark tool
12.	Applications of Information Security	Applications of Information Security to real world problems
13.	Wireshark	Understanding of Secure-socket layer, Application Layer (HTTP, FTP, DNS) using Wireshark tool

Project based learning: The students are grouped into groups of size 2-3 and will be implementing a secure client server program with required encryption techniques. The student will analyze the requirements and select the required solutions. This will help in the employability of students in the information security sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Information Security, Principles and Practice, , 2nd Edition, Mark Stamp, Wiley, 2011

2.	Security in Computing 5th Edition , Charles P Fleeger et. al. - Prentice Hall, 2015
3.	The InfoSec Handbook: An Introduction to Information Security- Apress Open, Nayak, Umesha, and Umesh Hodeghatta Rao, 2014
4.	Information Security: The Complete Reference, 2nd Edition- Mark Rhodes Ousley, 2013
5.	Cracking Codes with Python: An Introduction to Building and Breaking Ciphers-Al Sweigart, 2018