SERAMPORE GIRLS' COLLEGE
Department of Computer Science
Lesson Plan 2023 24

Semester	Paper	Unit/ Module	Topic	Hours	Faculty Name
Sem – I (Major & Minor)	DSC/CC1 Computer Fundamentals and Digital Logic	Computer Fundamentals	Central Processing Unit (CPU), Primary memory and Secondary Storage devices, I/O devices, generation and classification of Computers: Super, Mainframe, Mini and Personal Computer, System and Application Software, basic concepts on machine, assembly and high level language.	02	Moumita Ghosal
		Number Systems	Weighted and Non - Weighted Codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Gray Codes, Alphanumeric codes, ASCII, EBCDIC, Conversion of bases, signed arithmetic, 1's, 2's complement representation, Parity bits. Single bit error detection and correcting codes: Hamming Code. Fixed and floating point Arithmetic.	03	Moumita Ghosal
		Boolean Algebra	Fundamentals of Boolean Expression: Definition of Switching Algebra, Basic properties of Switching Algebra, Huntington's Postulates, Basic logic gates (AND, OR, NOT), De Morgan's Theorem, Universal	04	Indrani Guha (Dept. of Electronics)

			Content	Lectures	Faculty
			Logic gates (NAND & NOR), XOR and others, Minterm, Maxterm, Minimization of Boolean Functions using Karnaugh-Map up to four (4) variables, two level and multilevel implementation using logic gates, simplification of logic expressions.		
		Combinational Circuits	Adder & Subtractor: Half adders (2-bit), half Subtractor (2-bit), Full Adder (3-bit), Full Subtractor (3-bit) realization using logic gates, Carry Look Ahead adders, BCD adder, 1's and 2's complement adders/subtractor unit using 4-bit parallel adders.	05	Indrani Guha (Dept. of Electronics)
		Data Selector/Multiplexer:	Realization of multiplexers (4 to 1 and 8 to 1) using logical gates, expansion (Cascading), realization of AND, OR and NOT using multiplexers, realization of different Boolean expressions (SOP) using multiplexers.	03	Indrani Guha (Dept. of Electronics)
		Data Distributor:	De-multiplexer, Cascading, realization of various functions	01	Indrani Guha (Dept. of Electronics)
		Encoders:	Realization of simple and priority encoders using basic and universal logic gates	01	Indrani Guha (Dept. of Electronics)

		Chip Selector/Minterm Generator:	Chip Selector/Minterm Generator:	02	Indrani Guha (Dept. of Electronics)
		Parity bit, Code Converters and magnitude comparators	Parity bit generator/checker, Gray to binary code, binary to Gray code and Gray to Excess‑3 code converter, 2 & 3 bit magnitude comparators.	02	Indrani Guha (Dept. of Electronics)
		Latch & Flip-Flops:	Basic Set/Reset (SR) Latch using NAND and NOR gates, Gated S-R latches, Gated D Latch, Gated J-K Latch, race around condition, Master-Slave J-K flip flop, negative and positive clock edge detector circuits, edge triggered SR, D, JK, and T flip flop, flip-flop Conversions.	03	Indrani Guha (Dept. of Electronics)
		Registers:	Serial Input Serial Output (SISO), Serial Input Parallel Output (SIPO), Parallel input Serial Output (PISO), Parallel Input Parallel Output (PIPO), Universal Shift Registers.	02	Indrani Guha (Dept. of Electronics)
		Counters: Asynchronous Counter	UP/DOWN Counters, Mod - N Counters, BCD Counter (Counter Construction using J-K and T Flip Flops).	02	Indrani Guha (Dept. of Electronics)
		Synchronous Counter:	UP/DOWN Counters, Mod-N Counters, Ring & Johnson Counters.	02	Indrani Guha (Dept. of Electronics)

		Integrated Circuits (Qualitative Study): DTL, TTL:	Concepts of Fan in & out, TTL NOT, TTL NAND & NOR, NMOS, PMOS, CMOS, IC fabrication (Concepts only): SSI, MSI, LSI, VLSI, ULSI.	01	Indrani Guha (Dept. of Electronics)
	Core Course/DSE, CMSA- Practical: Computer Fundamentals and Digital Logic Lab			15	Indrani Guha (Dept. of Electronics)
	SEC -1 CMSA- Theory: Data visualization using spreadsheet	Introduction to Spreadsheets	Spreadsheets and their applications, overview of spreadsheet software (e.g., Open office, Google Sheets, Excel), creating workbooks, modifying workbook, modifying workbook, zooming in on a worksheet, arranging multiple workbook windows, adding buttons to the quick access toolbar, customizing the ribbon, maximizing usable space in the program window navigating the spreadsheet interface, entering and editing data in cells saving, opening, and closing spreadsheet files.	02	Moumita Ghosal
		Working with Data and Tables	Entering and revising data, moving data within a workbook, finding and replacing data, correcting and expanding upon worksheet data, defining tables.	02	Moumita Ghosal

		Performing Calculations on Data	Naming groups of data, creating formulas to calculate values (e.g., SUM, AVERAGE, COUNT), summarizing data that meets specific conditions (e.g., AVERAGEIF, COUNTA, COUNTBLANK, COUNTIFS, SUMIF, IFERROR etc), finding and correcting errors in calculations.	02	Moumita Ghosal
		Changing Workbook Appearance	Formatting Cells, defining styles, workbook themes and table styles, making numbers easier to read, changing the appearance of data based on its value, adding images to worksheets.	02	Moumita Ghosal
		Data Analysis and Manipulation	Limiting data appearance on screen, working with text functions for data cleaning, Splitting and combining data, Data normalization and standardization, working with ranges and named ranges, conditional formatting, data validation and error checking, using logical functions (e.g., IF, AND, OR), sorting and filtering data.	02	Moumita Ghosal
		Advanced Spreadsheet Features	Creating and managing tables, creating and modifying pivot tables, using lookup functions (e.g., VLOOKUP, HLOOKUP), working with charts and graphs, importing and exporting data	02	Moumita Ghosal

		Statistical Functions and Analysis	Descriptive statistics (mean, median, mode, variance, etc.), Calculating measures of central tendency and dispersion, Correlation and regression analysis, Hypothesis testing and confidence intervals, Analysis of variance (ANOVA)	03	Moumita Ghosal
		Pivot Tables and Data Aggregation	Creating pivot tables for data summarization, grouping and aggregating data by categories, Applying filters and slicers to pivot tables, calculating calculated fields and items.	02	Moumita Ghosal
		Advanced Data Visualization	Creating charts and graphs for data representation, Customizing chart elements (titles, axes, legends), Using sparklines and data bars for visual analysis, Creating interactive dashboards, Incorporating trendlines and forecasting in charts.	03	Moumita Ghosal
		Exploratory Data Analysis	Identifying patterns and outliers in data, Creating histograms and box plots, Using conditional formatting for data visualization, Data segmentation and drill-down analysis, Applying data validation rules for data integrity.	02	Moumita Ghosal
		Advanced Analysis Techniques	Using goal seek and solver for optimization problems, Performing "what-if" analysis with data tables, Simulating data using random number functions,	02	Moumita Ghosal

			Monte Carlo simulation for risk analysis, creating scenario analysis models.		
		Reporting and Presentation of Results	Designing informative reports and summaries, creating interactive dashboards for data presentation, data visualization best practices, documenting data analysis processes presenting findings to stakeholders.	02	Moumita Ghosal
		Collaboration and Sharing	Protecting worksheets and workbooks, sharing spreadsheets with others, tracking changes and commenting, collaborating in real-time, using version history and revision control.	02	Moumita Ghosal
	SEC -1- Practical - Data visualization using spreadsheet			10	Moumita Ghosal
	INTERDISCIPLINARY COURSE	Introduction to computers and computing	History of computing and the different types of computers that are available today, Generations of computers, Basic Building blocks (CPU, Memory, I/O Devices), types of computer (Mainframe, Desktop, Laptop, System on Chip). Classification of Software – System and Application Software, Basic Security Anti-Virus.	04	Dr. Mayurakshi Nag (Dept. of Mathematics)

		Data representation and number systems	Concept of binary code, ASCII and how it is used to represent data in computers, How different number systems work	03	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Algorithms and data structures	Basic concepts of algorithms and data structures: Common algorithms and data structures, such as sorting algorithms and linked lists.	03	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Office suite	Word processors, Spreadsheets, and Presentation	03	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Programming languages	Basic concepts of programming languages: types of programming languages , machine language, assembly language, high level language, Introduction to writing basic programs in Python (Finding prime numbers, finding GCD of two numbers etc,)	04	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Networking	Basic concept of networking and how computers communicate with each other, LAN, WAN, Introduction to the concept of the internet and how it works. Mobile communication	03	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Artificial intelligence	Basic concept of artificial intelligence and how it is used in computers. Introduction to Machine Learning, Preliminary concept of Big Data,	03	Dr. Mayurakshi Nag (Dept. of Mathematics)

			Recommendation System, Conversation Agents like ChatGPT, Prompt Engineering		
		Information and Communications (ICT) Tools	Importance of ICT tools, different types of ICT tools and their uses	01	Dr. Mayurakshi Nag (Dept. of Mathematics)
Sem - II	DSC/CC2 Theory: Problem Solving using C	Introduction to Programming	The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages, Compiler, Interpreter, Assembler, Linker and Loader, Testing and Debugging, Documentation	02	Moumita Ghosal
		Algorithms/ Flowchart for Problem Solving	Exchanging values of two variables, summation of a set of numbers, decimal base to binary base conversion, reversing digits of an integer, GCD (Greatest Common Division) of two numbers, test whether a number is prime, organize numbers in ascending order using bubble sort, find integer square root of a number, factorial computation, Fibonacci sequence, evaluate 'sin x' as sum of a series, reverse order of elements of an array, find largest number in an array, print elements of upper triangular matrix, multiplication of two matrices, evaluate a Polynomial.	03	Moumita Ghosal

		Introduction to 'C' Language	Character set, variables, identifiers and their nomenclature, built-in data types, variable declaration, arithmetic operators and expressions, constants and literals, simple assignment statement, basic input/output statement, simple 'C' programs.	01	Moumita Ghosal
		Conditional Statements and Loops	Decision making within a program, conditions, relational operators, logical connectives, if statement, if-else statement, Loops: while loop, do while, for loop, nested structure, infinite loops, switch-case, break, continue statement, structured programming	03	Moumita Ghosal
		Arrays	One dimensional arrays: Array manipulation; Searching, Insertion, deletion of an element from an array; finding the largest/smallest element in an array; two dimensional arrays, addition/multiplication of two matrices, Transpose of a square matrix; null terminated strings as array of characters, standard library string functions.	03	Moumita Ghosal
		Functions	Top-down approach of problem solving, modular programming and functions, standard library of C functions, Prototype of a function: Formal parameter list, return	02	Moumita Ghosal

			type, function call, block structure, passing arguments to a function: call by reference, call by value, Recursive functions, arrays as function arguments.		
		Storage Classes	Scope and extent, Storage Classes in a single source file: auto, extern and static, register, Storage Classes in a multiple source files: extern and static	01	Moumita Ghosal
		Structures and Unions	Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions	02	Moumita Ghosal
		Pointers	Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Array of Pointers, pointer to an array, pointers and structures, dynamic memory allocation.	03	Moumita Ghosal
		Self-Referential Structures and Linked Lists	Creation of a singly connected linked list, Traversing a linked list, Insertion into a linked list, Deletion from a linked list	02	Moumita Ghosal
		File Processing	Concept of Files, File opening in various modes and closing of a file, Reading from a file, Writing onto a file, Appending to a file. Organizing C projects, working with multiple source directories, makefiles.	02	Moumita Ghosal

	CMSA- Practical: Problem Solving using C		Introduction to 'C' Language	15	Moumita Ghosal
	SEC - CMSA- Theory: Web development	Introduction to Web development	Overview of web technologies and the role of HTML and CSS, understanding the structure of a web page, introduction to web browsers and developer tools.	01	Asmita Mukherjee
		HTML Fundamentals	Introduction to HTML tags and elements, creating headings, paragraphs, lists, and links, working with images and multimedia content, creating forms for user input.	02	Asmita Mukherjee
		CSS basics	Introduction to CSS and its role in web page styling, selectors, properties, and values, applying inline, internal, and external style sheets, formatting text, backgrounds, and borders.	02	Asmita Mukherjee
		CSS Layout and box model	Understanding the box model and its impact on layout, working with margins, padding, and borders, positioning elements using floats, positioning properties, and flexbox, creating responsive layouts with media queries.	02	Asmita Mukherjee
		Typography and colors	Styling text with fonts, sizes, weights, and styles, formatting text using CSS properties, understanding color models and applying colors to elements.	02	Asmita Mukherjee

		Images and multimedia	Working with images: sizing, aligning, and optimizing, incorporating videos and audio into web pages, implementing responsive images and media.	02	Asmita Mukherjee
		CSS Selectors and specificity	Understanding CSS selectors and specificity, applying styles to specific elements and classes, using pseudo-classes and pseudo-elements.	02	Asmita Mukherjee
		Responsive Web design	Introduction to responsive design principles, creating fluid layouts using CSS media queries, adapting web pages for different screen sizes and devices.	02	Asmita Mukherjee
		CSS Frameworks and libraries	Overview of popular CSS frameworks (e.g., Bootstrap, Foundation), using pre-built CSS components and grids, customizing and integrating CSS frameworks into web projects.	03	Asmita Mukherjee
		Web development best practices	Organizing and structuring code files and directories, validating HTML and CSS code, optimizing web pages for performance, introduction to version control with Git.	02	Asmita Mukherjee
		Building and deploying a website	Planning and designing a basic website structure, Implementing HTML and CSS to create the website, testing and debugging the website across different browsers, deploying the website to a local host/web server	03	Asmita Mukherjee

				10	Asmita Mukherjee
	CMSA- Web development SEC, Laboratory				
Sem – III	CMS-A-CC-3-5-TH Computer Organization and Architecture	Basic Structure of Computers (Qualitative Discussion)	Computer Types, Basic Functional Units, Basic Operational Concept, Bus Structure, Software, Performance, Multiprocessor and Multicomputer, IAS Computer, Historical perspectives.	02	MOUMITA GHOSAL
		Register Transfer and Micro-operation	Register Transfer Language, Register Transfer, Bus and Memory Transfers, Three State Bus Buffers, memory Transfer, Arithmetic and Logical micro-operations, Shift and Arithmetic shifts.	02	MOUMITA GHOSAL
		Basic Computer Organization and Design	Instruction Codes, Stored Program Organization, Indirect Address, Computer Registers, Common Bus System, Computer Instruction, Timing and Control, Instruction Cycle, fetch Decode, Register Reference Instructions, Memory Reference Instruction, Input-Output and Interrupt, Design of Basic Computer, Design of Accumulator Logic.	03	MOUMITA GHOSAL
		CPU Organization	Arithmetic and Logic Unit (ALU)- Combinational ALU, 2'S Complement Addition, Subtraction Unit, Booths Algorithm for Multiplication, Division Hardware using Restoration	03	MOUMITA GHOSAL

			Division Algorithm. General register organization, Control Word, Accumulator Based, Register Based, Stack Type CPU organization.		
		Control Unit	Hardwired Control Unit, Micro-programmed Control Unit: Control memory, Address Sequencing, conditional branching, mapping of instructions, subroutine, Design of Control Unit.	03	MOUMITA GHOSAL
		CPU Registers	Program Counter, Stack Pointer Register, Memory Address Register, Instruction Register, Memory Buffer Register, Flag registers, Temporary Registers	02	MOUMITA GHOSAL
		Instructions	Operational Code, Operands, Zero, One, Two and Three Address Instruction, Instruction Types, Addressing modes, Data Transfer and Manipulation instructions, Program control instructions.	02	MOUMITA GHOSAL
		CISC and RISC processors	Introduction, relative merits and De-merits.	01	MOUMITA GHOSAL
		Computer Peripherals	VDU, Keyboard, Mouse, Printer, Scanner (Qualitative approach).	01	MOUMITA GHOSAL
		Input / Output Organization	Polling, Interrupts, subroutines, Memory mapped IO, IO mapped IO, DMA, I/O Bus and Protocol, SCSI, PCI, USB, Bus Arbitration.	02	MOUMITA GHOSAL
		Memory	Primary memory: ROM, PROM, EPROM, EEPROM, Flash memory, RAM: SRAM, DRAM, Asynchronous	04	MOUMITA GHOSAL

			DRAMs, Synchronous DRAMs, Structure of Larger Memories, RAMBUS Memory, Cache Memory: Mapping Functions, Replacement Algorithms, interleaving, Hit and Rate penalty, Virtual memories, Address Translation, Memory Management requirements, Secondary Storage: Magnetic Hard Disks, Optical Disks, Magnetic Tape Systems.		
	CMS-A-CC-3-5-PRAC	Computer Organization Lab	Construct an Arithmetic Unit capable of performing 4-bit subtraction and Addition using 2's complement method. Use Parallel Adders and other necessary logic gates. Construct a logical unit using logic gates capable of performing 4-bit, Bitwise ORing, ANDing, XORing and inversion	01	Indrani Guha (Dept of Electronics)
			Construct a 2-bit Carry Look Ahead Adder using logic gates.	01	Indrani Guha
			Study and Construct a 1-digit BCD/Decimal adder using parallel adders and other necessary logic gates	01	Indrani Guha
			Construct a Binary Multiplier using basic logic gates.	01	Indrani Guha
			Construct a Binary 4-bit and 8-bit adder using logic gates	01	Indrani Guha
			Construct a Serial in Serial out 4-bit register. Construct a 4-bit Universal Shift register.	01	Indrani Guha

	CMS-A-CC-3-6-TH Computational Mathematics	Introduction	Set Theory: Finite and Infinite Sets, Uncountable Infinite Sets, Relations: Properties of Binary Relations, Closure, Partial Ordering Relations, Equivalence, Functions: definition, one-to-one, onto and invertible, Mathematical Functions: Exponential and Logarithmic, Counting: Mathematical Induction, Pigeonhole Principle, Permutation and Combination, Binomial Theorem, Principle of Inclusion and Exclusion.	03	Dr. Mayurakshi Nag (Dept of Mathematics)
		Introduction to Probability	Elementary events, Sample space, Classical and Axiomatic definition of Probability, Theorems on Total Probability, Conditional Probability, Bernoulli Trials and Binomial Distribution, Bayes' Theorem, Random Variables, Expectation, Variance, Standard Deviation	03	Dr. Mayurakshi Nag
		Growth of Functions	Asymptotic Notations, Standard notations and common functions with simple examples.	01	Dr. Mayurakshi Nag
		Recurrences	Relations, Generating Functions, Linear Recurrence Relations with Constant Coefficients and their solution, Substitution Method, Recurrence Trees.	03	Dr. Mayurakshi Nag
		Numerical Methods (Algorithmic Approach)	Errors: Approximate and Rounding of Numbers, Significant digits, Errors and their	10	Dr. Mayurakshi Nag

			types, Propagation of errors. Interpolation: Newton Forward and Backward interpolation, Lagrange interpolation. Solving a Set of Linear Equations: Gaussian Elimination, Gauss–Jordan, Iteration methods and their convergence conditions, Gauss-Seidel, Gauss-Jacobi Iterative Methods. Solving Non-linear equations: Bisection, Regula-falsi, Secant and Newton-Raphson, their order of convergence. Solving Differential Equations: Euler, Runge-Kutta second and fourth order methods. Numerical Integration: Trapezoidal and Simpson's 1/3rd rules. Curve fitting : Least square approximation, Linear regression, Polynomial regression, Fitting Exponential and Trigonometric functions		
		Graph Theory	Basic Terminology, Models and Types, Multi graphs and Weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Trees and their basic terminologies and properties	05	Dr. Mayurakshi Nag
	CMS-A-CC-3-6-P: Computational Mathematics Lab.		Lab. based on Numerical Methods using C	10	Dr. Mayurakshi Nag

	CMS-A-CC-3-7-TH: Operating Systems	Introduction	Basic OS functions, types of operating systems- batch processing, multiprogramming, time sharing, multiprocessing, distributed and real time systems.	03	Moumita Ghosal
		Operating System Organization	Processor and user modes, kernels, system calls and system programs.	02	Moumita Ghosal
		Process	System view of the process and resources, process control block, I/O and CPU bound process, process hierarchy, concept of threads Process Scheduling: Preemptive and non-preemptive scheduling, Long term scheduling, short term/CPU scheduling (FCFS, SJF, SRJF, RR and priority) and medium term scheduling Process Synchronization: Concurrent processes, critical section, semaphores and application, methods for inter-process communication;	08	Moumita Ghosal
		Deadlock	Definition, Prevention, Avoidance, Detection, Recovery.	03	Moumita Ghosal
		Memory Management	Physical and logical address space; memory allocation strategies – fixed and variable partitions, paging, segmentation, virtual memory	06	Moumita Ghosal
		File and I/O Management	Directory structure, file operations, file allocation methods, disk management.	02	Moumita Ghosal
		Protection and Security	Policy mechanism, Authentication	01	Moumita Ghosal

	CMS-A-CC-3-7-P: Operating Systems Lab.		Shell programming in LINUX	10	Moumita Ghosal
	CMS-A-SEC-A-3-1-TH: Computer Graphics	Introduction	Basic concepts of Graphics Devices– CRT monitor, Monochrome and Color Monitor displaying technique only, Physical and logical units of graphics devices – Pixel and its different properties, Basic idea for image or picture formation using pixels – Raster Scan and Vector Scan.	02	Moumita Ghosal
		Basic geometrical shapes formation algorithms	Concepts Co-ordinate System, Line Segment, Digital Differential Analyzer, Circle and arc segment, elliptic segment, Bresenham's and Midpoint scan conversion algorithms.	02	Moumita Ghosal
		Two and Three Dimensional Transformations	Transformations operations - Translation, Rotation, Scaling. Reflection, Shearing and Inverse of these operations, Homogeneous coordinate system representation, matrix representation. Composite Transformations Operations – Basic ideas and matrix representations by matrix concatenation for a particular operation.	07	Moumita Ghosal
		Two Dimensional Clipping	View port, window port, display device, Point Clipping, Line Clipping, Cohen-Sutherland line clipping algorithm, Sutherland Hudgeman polygon clipping algorithm	04	Moumita Ghosal

		Projection	Basic Concept of Projection operation and its application, Classification – Perspective, Parallel and its subclasses, Principles of these projections (Geometric representation only, no Mathematical Foundation and algorithms)	03	Moumita Ghosal
		Applications	Basic Concepts Computer Art, Animation – Animating and modeling of real world, Morphing – Classification of morphing and Application to the Advertisements and publicities.	01	Moumita Ghosal
SEM IV	CMS-A-CC-4-8-TH: Data Communication, Networking and Internet Technology	Introduction:	Data communications Components, data representation, direction of data flow (simplex, half duplex, full duplex). Network Hardware: Physical structure (type of connection, topology), categories of network (LAN, MAN, WAN). Internet: Brief history, Protocols and standards, Reference models: OSI reference model, properties of all the layers, TCP/IP reference model, their comparative study	02	Moumita Ghosal
		Physical Layer	Data & Signals: Analog & Digital Data and Signals, periodic and non-periodic signals, composite signals, bandwidth, bit rate, transmission of digital signals. Transmission Impairments: Attenuation, Distortion and Noise. Data Rate	06	Moumita Ghosal

			Limits: Noiseless Channel: Nyquist Data rate, Noisy Channel: Shannon's Capacity, calculation of data rate using both limits. Digital Transmission Digital to Digital Conversion: Line coding, schemes (RZ, NRZ, Manchester, Differential Manchester), block coding. Analog to Digital Conversion: Sampling, Nyquist rate of sampling, Pulse code modulation (PCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM), parallel and serial transmission. Analog Transmission Digital to Analog: Amplitude shift keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Amplitude Modulation (QAM). Analog to Analog Conversion: Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation.		
		Bandwidth Utilization Techniques	Multiplexing: FDM, Synchronous & Statistical TDM, WDM.	02	Moumita Ghosal
		Transmission Medium	Guided media: Twisted pair, Coaxial, Fiber optics. Unguided: Radio waves, microwaves, Infrared, Antenna, Communication satellites (qualitative study only).	03	Moumita Ghosal
		Switching and Telephone network	Circuit switched networks, Packet Switched networks,	01	Moumita Ghosal

			Virtual Circuit switch. Major components of telephone network, Dial up modem, DSL and ADSL modems, Cable TV for data transfer (qualitative study only		
		Data link Layer	Types of errors, framing (character and bit stuffing), error detection & correction methods, Linear and cyclic codes, checksum. Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC (qualitative study only). Physical addressing: MAC address and its format.	02	Moumita Ghosal
		Medium Access sub layer	Point to Point Protocol, Token Ring: Reservation, Polling. Multiple access protocols: Pure & Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA. Channelization: FDMA, TDMA, CDMA (Qualitative study only). Wired and Wireless LAN: Standards, fast Ethernet, Protocol 802.11, Bluetooth.	04	Moumita Ghosal
		Network layer	Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway, Addressing: IP addressing, Subnetting, Routing techniques: static vs. dynamic routing , Protocols: RARP, ARP, IP, ICMP	05	Moumita Ghosal
		Transport layer	Process to Process delivery: UDP, TCP	01	Moumita Ghosal
		Application Layer	Introduction to DNS, Remote logging, FTP,	02	Moumita Ghosal

			Electronic mail, WWW & HTTP		
	CMS-A-CC-4-8-P: Computer Networking and Web Design Lab			15	Moumita Ghosal
	CMS-A-CC-4-9-TH: Introduction to Algorithms & its Applications	Introduction to Algorithms	Definition, Characteristics, Recursive and Non-recursive algorithms	03	Asmita Mukherjee
		Asymptotic Complexity Analysis of Algorithms	Space and Time Complexity, Efficiency of an algorithm, Growth of Functions, Polynomial and Exponential Complexity, Asymptotic Notations: Big O Notation and Small o notation, Big Ω and Small ω, Big Θ and Small φ Notations, Properties: Best case/worst case/average case analysis of well-known algorithms	05	Asmita Mukherjee
		Algorithm Design Techniques	Concepts and simple case studies of Greedy algorithms. Divide and conquer: Basic concepts, Case study of selected searching and sorting problems using divide and conquer techniques: Dynamic programming: General issues in Dynamic Programming.	07	Asmita Mukherjee
		Graph Representation and Algorithm	Graph traversal algorithms: BFS, DFS, Minimal spanning trees: Prim's Algorithm, Kruskal's Algorithm, Shortest path algorithms: Floyd's Algorithm, Floyd-Warshall Algorithm, Dijkstra's Algorithm, Graph Coloring Algorithms	12	Asmita Mukherjee

		Classification of Problems	Concept of P, NP	02	Asmita Mukherjee
		CMS-A-CC-4-9-P: Algorithms Lab.	Lab. based on Graph Theory using C	10	Asmita Mukherjee
	CMS-A-CC-4-10-TH: Microprocessor and its Applications	Introduction to Microcomputer based system	Evolution of Microprocessor and Microcontrollers and their advantages and disadvantages	02	Indrani Guha (Dept. of Electronics)
		Microprocessor Architecture and Memory Interfacing	Basic Architecture of Microprocessor 8085 and explanation of each block, Microprocessor 8085 pin out and signals, Addressing modes, Instruction Formats, Instruction Cycle, Clock Cycle, Multiplexed Address Data Bus, Control and Status signals, Microprocessor and Bus Timing, De-multiplexing of Address Data Bus, Generation of Control Signals for I/O and Memory, Basic concepts in Memory Interfacing, Address Decoding and memory Addresses.	05	Indrani Guha (Dept. of Electronics)
		Interfacing I/O Devices	Basic Interfacing concepts, Peripheral I/O instructions (I/O mapped I/O), Device Selection and data Transfer, Absolute and Partial Decoding, Input Interfacing, Interfacing I/O using decoders, Memory mapped I/O techniques, Data transfer schemes, Interfacing 8155 memory segment.	05	Indrani Guha (Dept. of Electronics)
		Programming 8085	Instruction Set of 8085, Different Programming Techniques, Stack and Subroutines, Counter and Time Delays, Code	05	Indrani Guha (Dept. of Electronics)

			Conversion, BCD Arithmetic and 16 bit Data Operation.		
		Interfacing Peripheral Devices and Applications	Interrupts: 8085 Interrupt, RST instructions, Software and Hardware interrupt, multiple Interrupts and Priorities, 8085 Vectored Interrupts, Restart as Software Instructions. Interfacing Digital to Analog Converters, Analog to Digital Interfacing, keyboard interfacing, interfacing 8255 (Mode - 0, BSR), Support IC chips-8237/8257,8259	06	Indrani Guha (Dept. of Electronics)
		Microprocessor 8086	The 8086 microprocessor-Architecture, Instruction set, Addressing modes, Interrupts, Memory interfacing with 8086.	05	Indrani Guha (Dept. of Electronics)
	CMS-A-CC-4-10-P:Programming with Microprocessor 8085		programming techniques of Microprocessor 8085	15	Indrani Guha (Dept. of Electronics)
	CMS-A-SEC-B-4-2-TH: E-Commerce	An introduction to Electronic commerce	What is E-Commerce (Introduction And Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, 9 Electronic Commerce and Electronic Business (C2C) (C2G,G2G, B2G, B2P,	03	Moumita Ghosal

			B2A, P2P, B2A, C2A, B2B, B2C).		
		The Internet and WWW	Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.) , Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner, Exchange, Shopping Bots.	04	Moumita Ghosal
		Internet Security	Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime(Laws , Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus(How it spreads, Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature(How it Works).	05	Moumita Ghosal
		Electronic Data Exchange	Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange	03	Moumita Ghosal

			System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash.		
		Planning for Electronic Commerce	Planning Electronic Commerce initiates, Linking objectives to business strategies, Measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites.	02	Moumita Ghosal
		Internet Marketing	The PROS and CONS of online shopping, The cons of online shopping, Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.	02	Moumita Ghosal
Sem V	CMS-A-CC-5-11-TH: Database Management System (DBMS).	Introduction	Drawbacks of Legacy System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas and Instances; Database Languages; Database Users, DBA; Data Dictionary	02	Moumita Ghosal
		Entity Relationship(ER) Modeling	Entity, Attributes and Relationship, Structural Constraints, Keys, ER Diagram of Some Example Database, Weak and strong Entity Set, Specialization and Generalization, Constraints of Specialization and Generalization, Aggregation	02	Moumita Ghosal
		Relational Model	Basic Concepts of Relational Model;	03	Moumita Ghosal

			Relational Algebra; Tuple Relational Calculus; Domain Relational Calculus		
		Integrity Constraints	Domain Constraints, Referential Integrity, View.	02	Moumita Ghosal
		Relational Database Design	Problems of Un-Normalized Database; Functional Dependencies (FD),Derivation Rules, Closure of FD Set, Canonical Cover; Normalization: Decomposition to 1NF, 2NF, 3NF or BCNF Using FD; Lossless Join Decomposition Algorithm; Dependency preservation	05	Moumita Ghosal
		SQL	Basic Structure, Data Definition, Constraints and Schema Changes; Basic SQL Queries (Selection, Insertion, Deletion, Update); Order by Clause; Complex Queries, Aggregate Function and Group by Clause; Nested Sub Queries; Views, Joined Relations; Set Comparisons (All, Some); Derived Relations.	05	Moumita Ghosal
		Record Storage and File Organization (Concepts only)	Fixed Length and Variable Length Records; Spanned and Un-Spanned Organization of Records; Primary File Organizations and Access Structures Concepts; Unordered, Sequential, Hashed; Concepts of Primary and Secondary Index; Dense and Sparse Index; Index	02	Moumita Ghosal

			Sequential Files; Multilevel Indices		
	CMS-A-CC-5-11-P: Relational Database Management System		RDBMS Lab using My SQL & PHP	10	Moumita Ghosal
	CMS-A-CC-5-12-TH: Object Oriented Programming System (OOPs)	Concept of OOPs	Difference with procedure oriented programming, Data abstraction and information hiding: Objects, Classes, methods.	01	Asmita Mukherjee
		Introduction to Java	Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).	02	Asmita Mukherjee
		Arrays, Strings and I/O	Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability &	03	Asmita Mukherjee

			Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files		
		Object-Oriented Programming Overview	Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection	01	Asmita Mukherjee
		Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata.	Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.	07	Asmita Mukherjee
		Exception Handling, Threading, Networking and Database Connectivity	Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication,	07	Asmita Mukherjee

			suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.		
		Applets	Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.	06	Asmita Mukherjee
	CMS-A-CC-5-12-P: Object Oriented Programming Lab		OOPs Lab Using JAVA	10	Asmita Mukherjee
	CMS-A-DSE-A--1-TH: Digital Image Processing.	Introduction	Image definition and its representation, Pixels, Co-ordinate conventions, Image formats (Study of the image matrix), neighbourhood metrics, Sampling and quantization, Types of distance measure (concept only)	06	Asmita Mukherjee
		Spatial Domain	Image enhancement techniques in spatial domain, Contrast stretching, Histogram Processing, Noise	06	Asmita Mukherjee

			smoothing, Sharpening, Pixel Classification, RGB & Grey image. Transformation: Arithmetic Transformation, Logical Geometric Transformation, Hough Transformation, FFT. Filtering: Spatial domain filters: Convolution, Edge Detection Filters		
		Thresholding	Grey level thresholding, global/ local thresholding, Iterative thresholding, Edge detection operators, Region growing, Split/ merge techniques, Image feature/ primitive extraction, Background correction, Color enhancement	06	Asmita Mukherjee
		Image Segmentation	Boundary detection based techniques, Point, line detection, Edge detection, Local processing.	06	Asmita Mukherjee
	CMS-A-DSE-A--1-P: Image Processing Lab		Assignments on Different Image Processing Functions based on Open CV	10	Asmita Mukherjee
	CMS-A-DSE-B--2-TH: Programming using Python 3	Introduction to the Python	Interpreted vs. compiled languages. Bytecodes. The importance of whitespace. Variables and the lack of explicit data types and how Python uses the concepts of duck, strong, and static typing, to figure out data types in runtime. The assignment operator, the binding of names to objects, and aliasing. Keywords and their significance.	02	Asmita Mukherjee

| | | Strings, Lists and tuples | Strings: definition, declaration, and immutability, string constants, declaration, and the equivalence of single and double quotes. Multi-line strings. Raw strings. String formatting using the format function and the % operator. f-strings in Python 3.6+. Built-in functions: count, find, replace, upper, lower, strip, etc. Time and space complexities of the functions and operations. Lists: definition, declaration, and mutability. Nested lists. Indexing and slicing: same as strings. List comprehensions. The split and join methods. Built-in list functions – append, extend, count, find, index, etc. Time and space complexities of the functions and operations. Tuples: definition, declaration, and immutability. Packing and unpacking lists and tuples. The + and * operators on strings, lists, and tuples. Indexing and slicing strings, lists, and tuples. | 03 | Asmita Mukherjee |
| | | Conditionals, Iterators, and Generators | Conditionals: If, elif, and else statements. Nested conditionals. Containment checking in containers using the in keyword. Looping constructs: while and for loops. Flow control using break, continue, and pass. Nested loops. Generators: range, zip, sorted, | 07 | Asmita Mukherjee |

			reversed, and enumerate		
		User-defined Functions and Recursion	Functions: definition, function signature, positional, default, and keyword arguments. Documentation strings. Unnamed functions – lambda, filter, and map. Recursion: basic idea, implementing recursion, sharing variables across the recursion stack, modifying the size of the recursion stack	04	Asmita Mukherjee
		File Handling and Exception Handling	File handling: open and close methods, the different read and write modes. Using the with open approach to files. read, readline, readlines functions. The csv module for efficient read/write of structured data. The pickle module for persistent storage of variables in a program. Exception handling: the popular errors- Name Error, Value Error, Syntax Error, Key Error, Attribute Error, etc, and their cause and effects. Using try-except blocks for graceful handling of exceptions.	03	Asmita Mukherjee
		Unordered data types - Sets and Dictionaries	Basic concepts of hashing: hash functions, open chain, closed chain, advantages and disadvantages compared to conventional ordered data types. The hash() function in Python. Sets and frozensets: definition, declaration,	03	Asmita Mukherjee

			mutability, and advantages over lists / tuples. 05 hours Insertion, deletion, union, intersection, and other built-in operations. Time and space complexities of the functions and operations. Dictionaries: Concept of keys and values. Immutability requirement for keys. Basic operations on dictionaries. Iterating over the keys and key, value pairs of a dictionary. Dictionary inversions		
		Intro to Object Oriented Programming	The Python data model, magic methods (__init__, __str__, __eq__, etc) and their utilities, accessing and mutating data, constructors, class methods, and the lack of explicit access modifiers of class methods – naming conventions of private, protected, and public variables and methods. Inheritance: inheriting a parent class, the super() method. Basic multiple inheritance.	07	Asmita Mukherjee
	CMS-A-DSE-B--2-P: Python 3 Programming Lab			10	Asmita Mukherjee
Sem VI	CMS-A-CC-6-13-TH: Software Engineering	Introduction	Defining system, open and closed system, modeling of system through computer hardware, communication systems, external agents and software systems; Importance of Engineering Methodology towards	01	Moumita Ghosal

			computerization of a system		
		Software Life Cycle	Classical and Iterative Waterfall Model; Spiral Model; Prototype Model; Evolutionary model and its importance towards application for different system representations, Comparative Studies	03	Moumita Ghosal
		Software Requirement and Specification Analysis	Requirements Principles and its analysis principles; Specification Principles and its representations Software Design Analysis – Different level of DFD Design, Physical and Logical DFD, Use and Conversions between them, Decision Tables and Trees, Structured analysis, Coupling and Cohesion of different modules Software Cost Estimation Modeling – COCOMO	08	Moumita Ghosal
		Software Testing	Software Verification and Validation; Testing objectives, Testing Principles, Testability; Error and Faults; Unit Testing, White Box and Blank Box Testing, Test Case Design: Test Vector, Test Stub	05	Moumita Ghosal
		Software Quality Assurances	Concepts of Quality, Quality Control, Quality Assurance, IEEE Standard for Statistical Software Quality Assurances (SSQA) criterions	04	Moumita Ghosal
	CMS-A-CC-6-14-TH: Theory of Computation	Finite Automata	Definition of a Finite Automaton, Model, Representation, Classification – with respect to output function Mealy and Moore Machines, with	08	Moumita Ghosal

			respect to State Transition – Deterministic and Non-Deterministic Machine, Examples, conversion algorithms Mealy to Moore and Moore to Mealy, Finite and Infinite state machines, Finite Automaton, Deterministic and Non-Deterministic Finite automaton, Non-Deterministic to equivalent Deterministic Automaton-Optimized and Non-optimized technique ideas and algorithms, Acceptability of String by a Finite Automaton		
		Formal Languages and Grammar	Introduction to Formal Grammar and Language, Chomsky's Classification of Grammar – Type-0, Type-1 or Context Sensitive, Type-2 or Context Free and Type-3 or Regular Grammar, Illustration of each of these classes with example, Sentential form, Sentences – Languages or strings, Derivations, Ambiguous Grammar and Language, Designing of Grammar for a language, Find the Language for given Grammar, Definition and basic idea about Push Down Automaton	08	Moumita Ghosal
		Regular Expression	Basic Idea and Definition, Regular Expression basic Identities, Arden's Theorem – Statement (without Proof) and application for	08	Moumita Ghosal

			reduction of equivalent regular expressions, Regular expression to Finite Automata conversion, State Transition System to Regular Expression conversion algorithm by Arden's Algebraic Method, FA to Regular Grammar and Regular Grammar to FA conversion algorithms and applications.		
		Turing Machine	Concepts of Turing Machine, Formal Definitions, Classifications – Deterministic and Non-Deterministic Turing Machines, Simple Design of Turing Machines: Odd / even count and concepts of Universal Turing Machines, Difference and Similarities between Turing Machine and a General Purpose Computer, Definition and significant of Halting Problem in Turing Machine	08	Moumita Ghosal
	CMS-A-CC-6-14-P: Project Work				Moumita Ghosal, Asmita Mukherjee, Indrani Guha
	CMS-A-DSE-A--4-TH: Multimedia and its Applications	Multimedia	Introduction to multimedia, Components, uses of multimedia.	01	Moumita Ghosal
		Making Multimedia	Stages of a multimedia project, requirements to make good multimedia, Multimedia Hardware - Macintosh and Windows production Platforms, Hardware peripherals -	02	Moumita Ghosal

			Connections, Memory and storage devices, Multimedia software and Authoring tools.		
		Text	Fonts & Faces, Using Text in Multimedia, Font Editing & Design Tools, Hypermedia & Hypertext.	02	Moumita Ghosal
		Images	Still Images – Bitmaps, Vector Drawing, 3D Drawing & rendering, Natural Light & Colors, Computerized Colors, Color Palettes, Image File Formats.	02	Moumita Ghosal
		Sound	Digital Audio, MIDI Audio, MIDI vs Digital Audio, Audio File Formats.	02	Moumita Ghosal
		Video	Video How Video Works, Analog Video, Digital Video, Video File Formats, Video Shooting and Editing.	02	Moumita Ghosal
		Animation	Principle of Animations. Animation Techniques, Animation File Formats.	03	Moumita Ghosal
		Multimedia System	An overview of multimedia system and media streams, Source representation and compression techniques text, speech and audio, still image and video, Graphics and animation	05	Moumita Ghosal
		Multi-modal Communication	Video conferencing, networking support, Trans-coding	04	Moumita Ghosal
	CMS-A-DSE-A--4-P: Multimedia and its Applications Lab.		Sample practical problems can be included related to theory	10	Moumita Ghosal
	CMS-A-DSE-B--3-TH:Introduction to Computational Intelligence	Introduction	Introduction to Artificial Intelligence, Brief History and Application, Structures and Strategies for state space search-Data driven and goal	10	Asmita Mukherjee

			driven search, Heuristic search, Depth First and Breadth First search, Iterative deepening, A* algorithm, Game playing (Minimax), Rule-based system, Semantic Nets, Frames, Scripts, Conceptual Dependency, Introduction to PROLOG.		
		Neural Network	Basics of Artificial Neural Network, Characteristics and Comparison with biological neural network, Basic model of Artificial Neural Network: Single layer Perceptron model, Learning, Feed Forward Neural Network, Error, Back Propagation and weight updation, Perceptron, Bayesian Networks, Neural computational model-Hopfield Nets.	08	Asmita Mukherjee
		Rough sets	Basic difference between Rough sets and Fuzzy sets	01	Asmita Mukherjee
		Fuzzy Logic and Application	Fuzzy sets, application – basic operations, Properties, Fuzzy Relations, Fuzzy inference, Notion of Fuzziness, Operations on Fuzzy sets, Fuzzy Numbers, Brief overview of crisp sets, Crisp relations, Fuzzy relations, Max*-composition of fuzzy relation, Max*-transitive closure, Probability measures of fuzzy events, Fuzzy expected value, Approximate	08	Asmita Mukherjee

			reasoning, Different methods of role aggregation and defuzzification.		
	CMS-A-DSE-B-3-P:Computational Intelligence Laboratory		Computational intelligence lab using Prolog / LISP	10	Asmita Mukherjee
Computer Science (General)					
Sem III	CMS-G-CC-3-3-TH: Computer Organization	Basic Computer Organization:	IAS Computer, Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, Machine cycle, CPU Organization: Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer, CISC & RISC processors	06	Moumita Ghosal
		Instruction:	Operation Code and Operand, One, Two and Three address instruction. Instruction types	01	Moumita Ghosal
		Control Unit:	Control Structure, Hardwired Control and Micro programmed Control: Basic Concept, Parallelism in Micro-instruction	02	Moumita Ghosal
		ALU	Basic Structure of ALU, Addressing mode, Instruction Formats, Handling of interrupts and subroutines, Combinational ALU, 2's Complement Addition, Subtraction Unit, Booth's Algorithm for multiplication and division	04	Moumita Ghosal
		Memory	Types of Memory: Primary and Secondary; RAM, ROM, EPROM, EEPROM, DRAM, SRAM, PLA. Different storage technology; Memory Hierarchy: CPU Register, Cache	04	Moumita Ghosal

			Memory, and Virtual Memory		
		I/O:	Polling, Interrupts, DMA, I/O Bus and Protocol, Memory mapped I/O and I/O mapped I/O, I/O system organization and interfacing, Bus: SCSI, PCI, USB, Bus arbitration.	02	Moumita Ghosal
		Computer Peripherals:	VDU, Keyboard, Mouse, Printer, Scanner etc	02	Moumita Ghosal
	CMS-G-CC-3-3-P: Programming using Python			08	Moumita Ghosal
Sem IV	CMS-G-CC-4-4-TH: Operating Systems	System Software:	Introduction: Different System Softwares	01	Moumita Ghosal
		Introduction	Basic OS functions, types of operating systems- batch processing, multiprogramming, time sharing, multiprocessing, distributed and real time systems	02	Moumita Ghosal
		Operating System Organization	Processor and user modes, kernels, system calls and system programs	01	Moumita Ghosal
		Process	System view of the process and resources, process control block, I/O and CPU bound process, process hierarchy, concept of threads, Process Scheduling: Preemptive and non-preemptive scheduling, Long term scheduling, short term/CPU scheduling (FCFS, SJF, SRJF, RR and priority) and medium term scheduling Process Synchronization: Concurrent processes, critical section, semaphores and	08	Moumita Ghosal

			application, methods for inter-process communication;		
		Deadlock:	Definition, Prevention, Avoidance, Detection, Recovery.	03	Moumita Ghosal
		Memory Management	Physical and logical address space; memory allocation strategies –fixed and variable partitions, paging, segmentation, virtual memory	05	Moumita Ghosal
		File and I/O Management	Directory structure, file operations, file allocation methods, disk management	02	Moumita Ghosal
	CMS-G-CC-4-4-P: Shell Programming (Linux)			10	Moumita Ghosal
Sem V	CMS-G-DSE-A-5-1-TH: Database Management System	Introduction	Drawbacks of Legacy System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas and Instances; Database Languages	03	Moumita Ghosal
		ER Model:	Entity, Attributes and Relationship; Structural Constraints; Keys; ER Diagram of Some Example Database; Weak and Strong Entity Set; Symbolic Conventions; Specialization and Generalization; Constraints of Specialization and Generalization; Aggregation.	04	Moumita Ghosal
		Relational Model:	Basic Concepts of Relational Model; Relational Algebra; Tuple Relational Calculus	05	Moumita Ghosal
		Relational Database Design	Problems of Un-Normalized Database; Functional Dependencies (FD), Derivation Rules,	10	Moumita Ghosal

			Closure of FD Set, Membership of a Dependency, Canonical Cover; Decomposition to 1NF, 2NF, 3NF and BCNF using FD; Lossless Join Decomposition Algorithm; Dependency preservation.		
	CMS-G-DSE-A-5-1-P: DBMS Lab using SQL			10	Moumita Ghosal
Sem VI	CMS-G-DSE-B-6-3-TH: Computational Mathematics	Errors:	Introduction, Types of errors	01	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Interpolation	Newton's Forward and Backward Interpolation	02	Dr. Mayurakshi Nag (Dept. of Mathematics)
		System of Linear Equations	Properties: linear dependency, Rank, Singularity of coefficient matrix, Solution methods: Gaussian Elimination, Gauss-Jordan Elimination.	05	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Solution of Non-linear Equations	Bisection algorithm, Newton-Raphson method.	02	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Integration:	Trapezoidal and Simpson's 1/3rd Rules and their composite forms	03	Dr. Mayurakshi Nag (Dept. of Mathematics)
		Graph Theory: (concept only)	Basic Terminology, Models and Types, Multi graphs and Weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and properties of Trees	08	Dr. Mayurakshi Nag (Dept. of Mathematics)

	CMS-G-DSE-B-6-3-P: Computational Mathematics Lab		Lab. based on the Graph theory and Numerical Methods using C.	10	Dr. Mayurakshi Nag (Dept. of Mathematics)