Syllabus for B.Sc. Computer Science Honours (1st Year)

Sem	Paper	Topic	Period	Marks
Sem-I (July-Nov)	**CMSA3101**	Computer Fundamentals & Internet	30	30
		Circuit Theory & Basic Electronics	45	45
		Digital System Design	25	25
		Total Marks		**100**
	CMSA3151	Software Lab : PC S/W & C Programming	40	25
		Hardware Lab : Digital - 1	40	25
		Total Marks		**50**
Sem-II (Jan-May)	**CMSA3202**	Computer Organization	30	30
		Data Structure	40	40
		Mathematics	30	30
		Total Marks		**100**
	CMSA3252	Software Lab : Data Structures - 1	40	25
		Hardware Lab : Digital - 2	40	25
		Total Marks		**50**

SEMESTER-I
Paper- CMSA3101 (Theory)

Group-A: Fundamentals of Computer & Internet:

Introduction to Computer and Problem Solving: Information and Data
Hardware: CPU, Primary and Secondary storage, I/O devices, Bus structure, Computer Peripherals - VDU, Keyboard, Mouse, Printer.

Software: System and Application. Different System Software.

Programming Languages: Machine Language, Assembly Language, High Level Language, Object Oriented Language.

Problem solving: Algorithm, Flow charts, Decision tables & Pseudo codes.

Number systems and Codes: Number representation: Weighted codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notations, Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC, Single Error-Detecting and Correcting Codes, Hamming Codes.

Basic Computer Organization - IAS Computer, Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, Machine instruction and Assembly Language, CPU Organization, Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer.

 Introduction to Networking, Advantages of Networking; Basic Features, LAN, MAN and WAN; simple PC Based Network: Example, block diagram. Mode of operation and characteristic features.
Intranet and Internet; Servers and Clients; Ports; Domain Name Server (DNS); WWW, Browsers Connections: Guided and Unguided media - Dial up, ISDN, ADSN; Cable, Modem; E-mail, Voice and Video Conferencing.

Group-B: Digital System Design:

Boolean algebra: Fundamentals of Boolean algebra, Switches and inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR, switching function and Boolean function. De Morgan's Theorem. Application of Boolean algebra: Minterm, Truth Table and minimization of switching function up to four variables. Algebraic & K-map method of Logic circuit Synthesis: two level and multi level, 2 variables Boolean functions, 3 variables Boolean function

Combinational Circuits: Standard Gate assemblers, IC chips packaging nomenclature, Comparators, Decoders, De-multiplexers, Data selectors/multiplexer, Encoder, Seven segment display unit. Multiplexed display, Keyboard encoder.

Sequential Circuits: Flip-Flop (1 bit)SR, JK, D, T, Shift Register, Counter.
Finite State Model-State diagram, Synchronous and Asynchronous system (Illustrative counter design), Single and two phase clocks. Successive approximation, Basic ladder circuits, D/A and A/D converter, Counter Ramp, ROM & PLA (basic idea).

Logic Circuit design using TTL, MOS and CMOS circuits, Relative comparison.
Integrated Circuits : SSI, MSI, LSI, VLSI classification.

Group-C: Circuit Theory & Basic Electronics:

Passive circuit: parameters, equilibrium, conditions, Kirchoff's law; representation by differential equations; solutions; impedance and reactance.
LCR Circuits: frequency domain analysis, resonance and phases. Vector representation, resonance, and circuit diagrams. Network equations, signal flow graphs.
Theorems: superposition, reciprocity, Thevnin, Norton, maximum power transfer. Solutions using Laplace transformations: transient and steady state response. Transfer functions: poles and zeros.
Elementary physics of semiconductors: P-N junction diodes; Zener diodes; BJT; FET; MOSFET. Equivalent circuit for diodes, transistors, FETs. Operational amplifier (op amp).

Semester I: PAPER CMSA3151: 50 MARKS (PRACTICAL)

Group - A: Software Laboratory
PC S/W & Programming & Problem solving through C.
Assignment list to be provided.

Group - B: Hardware Laboratory
Digital – 1.
Assignment list to be provided.

SEMESTER-II
PAPER CMSA3202: Theory

Group - A: Computer Organization

Instruction: Operation Code and Operand. Zero, One, Two and Three address instruction. Instruction types. Addressing modes. Stack organization.
Memory: Types of Memory. Memory Hierarchy: CPU Register. Cache Memory, Primary Memory, Secondary Memory. Virtual Memory (Introduction only). Memory organization - Linear two-dimensional Von Neumann vs Harvard Architecture, Different storage technology.
I/O system organization and interfacing. Bus: SCSI, PCI, USB (introduction and comparative study); Tri State Devices, Bus Arbitration.
Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication & Division.
ALU - Combinational ALU, Two's Complement Addition, Subtraction unit
Control Unit: Control Structure and Behavior, Hardwired Control and Micro programmed Control: Basic Concept, Parallelism in Microinstruction, I/O: Polling, Interrupts, DMA, I/O Bus and Protocol.

Group - B: Data Structures

*Definition***:** Concepts of data types. Elementary structures, Data types and their interpretation.
Complexity: Advantages and Disadvantages. Big 0 Notation, Big-omega and Big-theta notations, Growth of Functions.
*Arrays***:** Types, Memory representation. Address translation. Functions of single and multi dimensional arrays with examples.
Linked Structures: Single and doubly linked list (non-circular and circular). List manipulation with pointers: Insertion and deletion of elements.
Stacks and Queues: Definition. Representation. Uses and Applications, Infix notation to postfix notation: conversion and evaluation. Application of queues.
Recursion: Divide and Conquer, Elimination of Recursion, When not to use recursion?
*Binary trees***:** Definition, Quantitative properties, Internal and external. Properties, Minimum and maximum path length of a binary tree. No of nodes, height.
Searching: Linear and binary search, Performance and complexity.
Hashing: Concepts, Advantages and disadvantages. Different types of hash functions, Collision and Collision Resolution Techniques - Open addressing with probing, Linear Chaining. Coalesced Chaining, Application.
Sorting: Terminology, Performance Evaluation, Different Sorting Techniques (Bubble, Insertion, Selection, Quick sort. Merge sort. Heap, Partition Exchange, Radix with iterative and recursive description).

Group - C: Mathematics

Logic: Propositions; Predicates and Quantifiers. Sets, Functions, Relation, Equivalence Relation.
Counting Theory: Counting, Pigeon Hole Principle, Permutations and Combinations, Introduction to Probability. Recurrence Relation, Generating Function, Inclusion and Exclusion Principle. Principle of mathematical induction.
Modeling discrete systems. Computation as a discrete process. Sets: membership, subsets, union, intersection, complement, difference. Symmetric difference. Venn diagrams. Propositions and predicates.
Constructions on sets. Cartesian product. Disjoint union (connection with data types). Relations as a subset of a product. Binary relations. Functions and partial functions.
Relations on a set. Reflexive, symmetric and transitive properties of a relation on a set. Equivalence relations. Orders, partial and total. Examples.
Graph Theory: *Graphs***:** Definition, Finite and Infinite graphs. Directed and undirected graphs, Degree, Isolated vertex, Pendant vertex. Null graphs. *Walks*: Paths and circuits. Connected and disconnected graphs, Euler's graphs, Hamiltonian paths and circuits. Trees, Definition and basic properties, Distance and contents. Matrix representation of graphs. Incidence, Adjacency and Circuit matrices. *Graph Search:* BFS, DFS, Spanning Trees, Shortest Path Problems.

Introduction to probability: Combinatorics, binomial coefficients, Random walks, Conditional probability and independence, Binomial, Poisson and normal distributions.

Semester-II: PAPER CMSA3252: 50 MARKS (PRACTICAL)

Group - A: Software Laboratory
Data Structures - 1
Assignment list to be provided.

Group - B: Hardware Laboratory
Digital – 2.
Assignment list to be provided.

Syllabus for B.Sc. Computer Science Honours (2nd Year):

Sem	Paper	Topic	Periods	Marks
Sem-III (July-Nov)	**CMSA3303**	Operating System	40	40
		Formal Language & Automata Theory	30	30
		Formal Language & Automata Theory	30	30
		Total Marks		**100**
	CMSA3353	Software Lab : Data Structures - II	25	25
		Software Lab : Linux & Shell Programming	25	25
		Total Marks		**50**
Sem-IV (Jan-May)	**CMSA3404**	Theory of DBMS	30	30
		Numerical and Optimizing Techniques	40	40
		Numerical and Optimizing Techniques	30	30
		Total Marks		**100**
	CMSA3454	Object Oriented Programming through Java	25	25
		SQL, PL-SQL, Forms & Reports	25	25
		Total Marks		**50**

SEMESTER-III
Paper CMSA3303 (Theoretical)

Group - A: Operating System
What is OS? Multiprogramming OS(Concurrent Processing System), Concepts of process & Threads, Concept of Interrupts, System Calls, OS is an interrupt driven system . Files, Shell, Introduction to shell programming, Structures of OS: Monolithic, Layered, Virtual, Client Server and Distributed Model. *Concepts of Synchronization*: Semaphores, Critical Regions, Monitor Inter Process Communication Mechanism. *Processor Management:* Scheduling, Round-robin, Priority Queue. I/O management: Device Management. *Memory Management*: Multiprogramming, Swapping, Paging, Virtual memory, Page Replacement Techniques. *File Systems*: Files and Directories, File Servers, Security and Protection. Dead Lock: Definition, Detection and prevention.

Group - B: Formal Languages & Automata Theory
Introduction to Formal Languages and Grammar, Finite automata. Regular expressions, Deterministic and Non-Deterministic Finite Automata and their Equivalence. State minimization, Chomsky Classification of Grammars, Concepts of Turing Machines & Universal Turing Machines.
Turing machines: basic concept and examples, difference with FSM, simple problems.

Group C: Data Communication & Computer Network
Data Communications; Transmission media; Network: Protocol and standards; Analog & Digital Signals, Periodic & Non-Periodic Signals, Time and Frequency Domain; Multiplexing: FDM, TDM and Application, Encoding D/A and A/D Encoding; Concepts of Centralized and Distributed Computing; Advantages of Networking; Layered architecture: OSI Architecture, Basic Features, LAN, MAN and WAN; simple PC Based Network: Example, block diagram. Mode of operation and characteristic features. IP addressing, Flow Control: Stop-and-wait, Sliding Window, and ARQ.

Semester-III:

PAPER – CMSA3353: 50 MARKS (PRACTICAL)

Group - A: Software Laboratory
Data Structures - 2
Assignment list to be provided.

Group - B: Software Laboratory
Linux & Shell Programming
Assignment list to be provided.

SEMESTER-IV
Paper CMSA3404 (Theoretical)

Group - A: Theory of DBMS
Basic concept. File Management systems. Advantages of DBMS, Physical, Conceptual and External Models, ER Diagram, Data Models: Relational, Hierarchical, Network; File Organisation: Sequential, Indexed Sequential, Random, Inverted; Query Languages, Relational Algebra & Calculus, Functional Dependencies, Normal forms : INF, 2NF, 3NF and BCNF; Structured Query Languages, Steps of query Processing. Concurrent Processing. Elementary Concepts of Security, Integrity.

Group - B: Numerical and Optimization Techniques
System of Linear Equations: Gaussian Elimination, Gauss-Jordan Elimination, Gauss-Seidel Iteration, Matrix Inversion *Nonlinear Equation*: Iterative Methods, Newton-Raphson. *Solution of Differential Equation* : Euler, Runge-Kutta. Curve Fitting, Romberg Integration. *Overview of Linear Programming*: Linear Programming, Simplex method, Duality, Transportation, Assignment problems. Integer Programming, Cutting Plane, Branch and Bound, Dynamic programming, PERT/CPM network. *Queuing Theory* : Basic concepts, Queuing models, Poisson Statistics, M/M/l queue; Applications.

Group - C: Object-Oriented Programming Concepts - Java
Concepts: Difference with procedure oriented programming. Data Abstraction and Information Hiding: Objects, Classes & Methods, Encapsulation, Inheritance, Polymorphism. Input-Output, Function and Operator overloading. Constructors and Destructors, Copy Constructors and Assignment Operator, Overloading, Single and Multiple Inheritance, Polymorphism and Virtual Functions, Namespace, Exception Handling, Templates.

Semester-IV:
PAPER – CMSA3454: 50 MARKS (PRACTICAL)

Group - A: Software Laboratory
Object oriented programming through Java
Assignment list to be provided.

Group - B: Software Laboratory
SQL, PL-SQL, Forms & Reports.
Assignment list to be provided.

Syllabus for B.Sc. Computer Science Honours (3rd Year):

Sem	Paper	Topic	Period	Marks
Sem-V **(July-Nov)**	**CMSA3505**	Computer Graphics	30	20
		Software Engineering & UML	35	25
		Microprocessor	45	30
		Design & analysis of algorithm	40	25
		Total Marks		**100**
	CMSA3555	Software Lab : MATLAB	30	30
		Software Lab : Advanced RDBMS (Oracle 9i)	15	20
		Hardware Lab : Microprocessor Application	75	50
		Total Marks		**100**
Sem-VI **(Jan-May)**	**CMSA3606**	Compiler	60	60
		Web technologies & Multimedia	30	20
		Current Technologies	30	20
		Total Marks		**100**
	CMSA3656 **CMSA3457**	Software Lab : Web Technologies	40	50
		Software Lab : VB .net	40	
		Project Work – under supervision of project guide	40	50
		Total Marks		**100**

SEMESTER-V:
Paper: CMSA3505 (Theoretical)

Group-A: Computer Graphics
Introduction : Co-ordinate System, Information Handling Software, Graphics Software, Area of Application, Translation, Rotation, Scaling, Matrix representation. Homogeneous Co-ordinate System, Composite Transformation, Inverse Transformation, Computer Art, Animation, Morphing, Projection & Clipping, 2D & 3D Transformations, Lines, Curves & Their Representations.

Books: Computer Graphics by D Hearn and P M Baker – PHI
Fundamentals of Introductive Computer Graphics by J D Foley & A Van Dam – Adison Wesely

Group - B: Software Engineering
Introduction, The Evolving role of software, Software Crisis, Important qualities of software product. The software life cycle, Software Development process models, Project Management, Software metrics, Role of software metrics, Size-oriented metrics, Function-oriented metrics, Metrics for software quality, Software Requirements and Specification, Need for SRS Characteristics of SRS, Components of SRS, Software Design, Design principles, Top-down and Bottom-up Strategies, Module level concepts, Coupling, Cohesion, Structured design, methodology, Structure charts, Design reviews, Coding, Programming style, Internal documentation, Verification, Software Testing and Maintenance, Testing Fundamentals, Types of testing, Software Maintenance, Software Quality assurance, Introduction to UML.

Books: Software Engineering by Roger S Pressman – TMH
Software Engineering by Ian Sommerville

Group - C: Microprocessor

Evolution of Microprocessor: Architecture of 8.bit and 16 - bit microprocessor Machine language instructions. Addressing Modes, Instruction formats, Instruction sets. Instruction cycle. Clock cycles, Timing diagrams. Interrupts, Bus standards and Interfacing concepts. Memory interfacing, I/O Interfacing and Ports - Keyboard Interfacing, Display Interfacing, Storage Device Interfacing, Programming a Microprocessor, Interrupt Handling, Methods of Interrupts Priority and Management Case Studies: 8085 and 8086 microprocessor, 32 bit processor.

Books: Introduction to Microprocessor by Gaonkar – PHI
Introduction to Microprocessor by Mukhopadhyay
Advanced Microprocessor by Tabak

Group - D: Design & Analysis of Algorithm

Mathematical Foundations: Introduction, Growth of functions, Summations, Recurrences. **Sorting and order statistics**: Heap sort, Merge Sort, Quick sort, sorting in linear time, Median and order statistics. **Design and analysis Techniques**: Divide and conquer; Dynamic programming; Greedy Algorithms; Back tracking. **Advanced data structures**: Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree **Graph Algorithms**: Breadth First Search, Depth First Search, Topological Sort, Connected Components, Minimal spanning Tree algorithms, shortest paths. **Computational Geometry**: Convex Hulls, Closest pair of points **Notion of NP-completeness** P class, NP-hard class, NP-complete class, Circuit Satisfiability problem

Books: Fundamentals of Computer Algorithms by Horowitz Ellis, Sahani Sartaz, R Sanguthevar
Introduction to Algorithms, Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, PHI
Design and Analysis of Algorithms, Dexter C.Kozen - Springler-Verlag.

SEMESTER-VI
Paper CMSA3606 (Theoretical)

Group A: Compiler

Basic concepts of compilers and interpreters. Different phases of compilation.
Lexical analyzer concept; Design using FSM.
Parser: Top down and Bottom up; Recursive descent; LL (1); LR (1); LALR (1); Comparison, Symbol tables: organization and management techniques. Runtime storage management - static
allocation; dynamic allocation, activation records; heap allocation, recursive procedures
Semantic Analysis - attributed translation: procedure calls. Syntax directed translation and intermediate codes.
Code Optimization: Basic blocks, loop optimization, flow graph. Machine dependent optimization, code generation. Error handling - detection, reporting, recovery and repair.
Compiler Writing Tools: LEX; YACC.

Books: Principles of Compiler Design by Aho & Ullman

Group B: Web technologies & Multimedia

Web pages – types and issues, Comparison of different technologies (eg. Microsoft, Sun-Micro systems, etc). WWW- basic concepts, web-client & web-server, application server, http protocol(frame format), universal resource locator (URL), HTML-different tags, sections, images & pictures, listings, tables, frames and forms..

Basic concepts on Multimedia, Different forms of multimedia- text, audio, image & video. Sound- types, computer representation of sound & sampling. Examples of audio tools (Sound forge, etc.). Animations – Tweening, Morphing in multimedia with examples.

Group C: Current Technologies

Mobile Computing, Artificial Intelligence, Bio-informatics, Image Processing, Data Mining, Embedded System, Distributed Computing.