



# School of Computer Science & IT Devi Ahilya Vishwavidyalaya

## SYLLABUS

### MCA 2 years

#### Program Educational Objectives (PEOs)

- PEO 1:** Nurture through in-depth knowledge of fundamental computing concepts and programming along with supplementary skills to bridge industry-academia gap.
- PEO 2:** Develop proficiency in application-based projects through latest technological trends.
- PEO 3:** Inculcate professional values with ethics to pursue career in industry or academia.

#### Program Specific Outcomes (PSOs)

- PSO 1:** Understand, analyze and develop computer programs in the areas related to algorithm, web design and machine learning for designing efficient software system.
- PSO 2:** Apply standard software engineering practices and strategies in software project development using modern computing tools and techniques with concern for societal, environmental, and cultural aspects.
- PSO 3:** Learn various issues, latest trends in technology development and thereby innovate new ideas and solutions to existing problems.

## I - SEMESTER

## CS-4009: Computer Organization and Architecture

**Aim:**

This course aims to give an understanding of the basic computer architecture, leading to strong foundation of assembly language, operating system, compilation process, performance aspects of software.

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**Course Outcomes:**

- CO 1: Theoretical foundation of computer architecture
  - CO 2: Practical understanding of Beta/8088 through Assembly Language
  - CO 3: Understanding of how to design a CPU
  - CO 4: conceptual clarity of different CPU architectures
  - CO 5: Exposure to multi processors.
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**Unit-I**

Computer Organization: Digital computers, Major components of a digital computer, Memory addressing capability of a CPU, Word length of a computer, Processing speed of a CPU, Technological trends. Von Neumann model, Functional units and components in computer organization: The memory unit, the input and output subsystem, the bus structures, design of ALU in context of Beta /8088 microprocessor.

**Unit-II**

Introduction to Beta/8088/8086 Microprocessor:Architecture,Register Architecture: Various instruction classification: Instruction Format, Opcode, Operand and Hex code. Addressing modes, Introduction to Assembly Language Programming: Various Instruction Sets: Arithmetic Group Instructions, Data Transfer Group Instructions, Logical Group Instruction, Branch Group Instructions: Conditional and Unconditional branch instructions, interrupts, Data path of a CPU.

**Unit-III**

Micro-Operations, Functional Requirements, Processor Control, Hardwired Implementation, Micro-programmed Control, Introduction to RISC and CISC Architecture, Instruction pipelining: Instruction pipelining hazards, data dependency hazards and control hazards, overcoming hazards.

**Unit-IV**

Internal Memory: RAM ,SRAM and DRAM, Interleaved and Associative Memory, Cache Memory : Data caches, instruction caches and unified caches, cache implementations, fully associative and direct mapped caches, write back versus write through caches.

**Unit-V**

Multi processors and Multi computer: Shared Memory Multi processors, UMA, NUMA, COMA, Distributed Memory Multi processor, Message Passing Scheme. Multi vector and SIMD Computers: Vector Supercomputers and SIMD Supercomputers.. Vector Processing, Array Processing and VLIW Architecture.

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**Text Books:**

1. Computer Organization & Architecture, William Stallings, 8e, Pearson Education.
2. Patterson, D.A., and Hennessy, J.L., "Computer Organization and Design: The Hardware/Software Interface", Morgan Kaufmann Publishers, 4th Edition, Inc. 2005.
3. Microprocessor Architecture, Programming and Applications with 8085/8080 by Ramesh S. Gaonkar.

**Reference Book(s):**

MIT Open Courseware Computation Structures

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## CS-4122: Mathematical Foundation for Computer Applications

**Aim:**

The students will be capable of using the mathematical methods and algorithms learned for analyzing and solving problems related to Computer Science. ☐ The students will get an overall view of concepts in probability and statistics.

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**Course Outcomes:**

- CO 1: The course aims to provide a general introduction to mathematics and its applications in computer science
  - CO 2: Discusses sets and functions, floor and ceiling functions, and their use in computer science.
  - CO 3: Introduces algorithms and the principle of mathematical induction.
  - CO 4: Discusses counting techniques, relations, graphs, and trees.
  - CO 5: Emphasizes on propositional logic and predicate calculus.
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**Unit-I**

The students will be able to understand the Concepts of mathematical logic, arguments, and reasoning, as well as the concepts of conjunction, disjunction, and negation of statements.

**Unit-II**

The students will be able to understand the concept of Relations and various properties relations as well as its representation in matrix and directed graph

**Unit-III**

The students will be able to understand the concept of functions and various relations as well as function mappings performed. Students will be able to have an understanding of various methods of generating coefficient of functions. Recurrence relation by substitution and generating root solution for homogeneous recurrence relation.

**Unit-IV**

Discuss basic ideas of linear regression and correlation. Create and interpret a line of best fit. Calculate and interpret the correlation coefficient. Calculate and interpret outliers.

**Unit-V**

Bayes Theorem is used to estimate the precision of values and provides a method for calculating the conditional probability.

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**Text Books:**

Discrete Structure by Dr. D.C.Agarwal

**Reference Book(s):**

Discrete mathematics and its applications, Kenneth H. Rosen, 5th edition. TMH

## CS-4209: Data Structures using C++

**Aim:**

This course aims to provide you with an understanding of data structures and algorithms, enabling you to assess how one is better in certain situations and another in others.

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**Course Outcomes:**

- CO 1: Understand data structure and their applications in solving Real World Problems.
  - CO 2: Understand sorting algorithms through various algorithms techniques.
  - CO 3: Evaluate algorithms and data structures in terms of space and time complexity.
  - CO 4: Exposure to recursion and its applications in solving Real World problems.
  - CO 5: Utilize data structures to algorithmically create effective software that can handle the intricacies of real-world applications.
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**Unit-I**

Introduction to Data Structure: Concepts of Data and Information, Classification of Data structures, Abstract Data Types, Data structures operations. Algorithms, Algorithm complexity notations like big Oh, Theta, and Omega. Time Complexity, Big –Oh -notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time. Implementation aspects: Memory representation. Static and Dynamic implementations. Examples and real life applications, Data Structures: Arrays, Address calculation in a single and multi dimensional array, Sparse Matrices, Pointer & Structure.

**Unit-II**

Stacks, Queues and Lists Definition, Array based implementation of stacks, Linked List based implementation of stacks, Examples : Infix, postfix, prefix representation, Applications : Mathematical expression Evaluation Definition: Queues & Lists: Array based implementation of Queues / Lists, Linked List implementation of Queues / Lists, Circular implementation of Queues and Singly linked Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority queues , Applications.

**Unit-III**

Trees & Graphs Definition of trees and Binary trees, Properties of Binary trees and Implementation, Binary Traversal; pre-order, post-order, in-order traversal, Binary Search Trees, Implementations, Threaded trees, AVL Trees, Implementations , Balanced multi way search trees, Applications Definition of Undirected and Directed Graphs and Networks, The Array based implementation of graphs, Adjacency matrix, path matrix implementation, The Linked List representation of graphs, Shortest path Algorithm, Graph Traversal –Breadth first Traversal, Depth first Traversal, Connectivity of graphs; Connected components of graphs, Weighted Graphs, Applications.

**Unit-IV**

Introduction to Recursion, Divide and Conquer Algorithm, Evaluating time Complexity. Straight Sequential Search, Binary Search, non –recursive Algorithms, recursive Algorithms, Indexed Sequential Search. Definition, Hash function, Collision Resolution Techniques, Hashing Applications.

**Unit-V**

Sorting Algorithms Introduction, Sorting by exchange, selection, insertions, Bubble sort, Selection sort, Insertion sort, Efficiency of algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays, The merge sort Algorithms, Quick sort Algorithm, Analysis of Quick sort, Picking a Pivot, A partitioning strategy, Heap sort, Heap Construction, Heap sort, bottom–up, Top–down Heap sort approach, Radix sort.

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**Text Books:**

- 1.Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub, 6thEdition.
- 2.How to Program C++ by Paul Deitel , Harvey Deitel, Prentice Hall; 8 edition.

**Reference Book(s):**

- 1.Theory & Problems of Data Structures by Jr. Seymour Lipschetz, Schaum'soutline by TMH 2006,Special Indian Edition.
- 2.Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
- 3.Fundamentals of Data structures by Ellis Horowitz & Sartaj Sahni, Pub, 1983,AW, 1st Edition.
- 4.Data Structures and Program Design in C By Robert Kruse, PHI, 2nd Edition.

## CS-5511: Operating Systems

**Aim:**

Understanding of modern computer's purpose, structure and functions of operating systems with illustration of key aspects through implementation.

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**Course Outcomes:**

- CO 1: Classify different types, design and architecture of operating system
  - CO 2: Analyze process management, I/O management, memory management functions of Operating System
  - CO 3: Solve numerical problems on Process Synchronization, CPU scheduling, Memory management and Disk management
  - CO 4: Explore file management and protection and security concepts
  - CO 5: Study and analyze various Operating Systems as research aspect
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**Unit-I**

Introduction: Evolution of operating systems, operating system concepts; activities, functions and services of operating system; Computer Systems: Mainframe, Desktop, Multiprocessors, Distributed, Clustered, Realtime and Handheld systems. Computer System Operations, Storage hierarchy, Hardware protection, System calls, System structures. Process Management: Process concepts, Process scheduling, Operation on processes.

**Unit-II**

Cooperating processes, Inter-process communication. Threads: multithreading models, threading issues, thread examples. CPU Scheduling: concepts, scheduling criteria, scheduling algorithms, algorithm evaluation. Process synchronization: Critical section problem, Mutual exclusion and synchronization Techniques of inter process: Synchronization hardware, semaphore, classical problems of synchronization, critical regions and monitors. Deadlock: deadlock characterization, deadlock handling methods.

**Unit-III**

Memory Management: Concepts, single user memory management. Partition memory allocation: paging, segmentation and segmentation with paging, Virtual memory management: concept, demand paging, process creation, page replacement, allocation of frames and thrashing.

**Unit-IV**

File Management: File concepts, access methods, directory structure, file system mounting, sharing and protection of files. File system structure and implementation, allocation methods, free space management, reliability of file system. Unix file system.

**Unit-V**

Device Management: Goals of input/output software design, Structure of device

hardware and software. Layers of I/O software, structure of device drivers, Disk driver, disk arm scheduling algorithms, terminal driver, clock driver etc.

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**Text Books:**

A. Silberschatz, P. Galvin and Gagne, Operating System Concepts, Addison Wesley, 6th Edition, 1994.

**Reference Book(s):**

Operating systems, 4th Edition, William Stallings, Pearson Education, 2003.

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## IC-4916: Communication skills and Report Writing

### Aim:

To enhance students' confidence, communication skills, and presentation abilities, preparing them for success in placements and corporate life.

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### Course Outcomes:

- CO 1: Strengthening the ability to speak assertively in various situations.
  - CO 2: Improving both written communication and non verbal communication.
  - CO 3: Developing the ability to understand others' perspectives and respond thoughtfully.
  - CO 4: Learning to structure content logically for ease of understanding.
  - CO 5: Developing confidence to speak during Interviews and Group discussions.
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### Unit-I

Fundamentals of Communication : Definitions, Importance, Forms of communication, Process of communication, Channels, Barriers and Strategies to overcome barriers of communication.

### Unit-II

Listening: Definitions, Importance, Benefits, Barriers, Approaches, Exercise and cases. Group Discussions : Definitions, Importance, Process, Points to be borne in mind while participating, Do's and Don'ts.

### Unit-III

Presentation Skills, Interviews: Types of Interviews, Points to be borne in mind as an Interviewer or an Interviewee. Commonly asked questions. Do's and Don'ts.

### Unit-IV

Transactional Analysis, Johari Window. Written Communication: Report Writing, Business Correspondence, Preparation of Manuals and Project Report, Minutes of meeting, Notes and Circulars.

### Unit-V

Intense practice of Presentations, Group Discussions and Interviews.

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### Text Books:

1. Business Communication – K. K. Sinha
2. Organizational Behavior - Fred Luthans
3. Organizational Behavior - Stephen Robbins

### Reference Book(s):

1. Effective Business Communication – M.V. Rodrigues
2. Business Communication - Lesikar and Flately