



# School of Computer Science & IT Devi Ahilya Vishwavidyalaya

## SYLLABUS

### M.Sc (Integrated) Cyber Security 5 years

#### Program Educational Objectives (PEOs)

- PEO 1:** Acquire comprehensive knowledge in cybersecurity and develop global competence for pursuing higher education or taking up advanced research challenges.
- PEO 2:** Demonstrate technical, analytical, teamwork, and entrepreneurial skills to innovate and address global cybersecurity challenges.
- PEO 3:** Excel as a cybersecurity professional, not only to address challenging issues of cybercrime but also to create awareness in society about potential threats.

#### Program Specific Outcomes (PSOs)

- PSO 1:** Acquire knowledge of secure computing systems and networks, and apply that knowledge to design and implement robust security solutions.
- PSO 2:** Develop expertise in identifying, assessing, and mitigating cyber threats using modern tools, while adhering to ethical and legal standards in cybersecurity.

## II - SEMESTER

# CS-3027: COMPUTER SYSTEM ARCHITECTURE

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## Course Outcomes (COs):

**CO1:** To study the evolution of computer architecture.

**CO2:** Ability to represent data in binary form, perform arithmetic operations in binary.

**CO3:** Understanding the design of hardware and software components of computer systems.

**CO4:** Applying the techniques to develop assembly language programme.

**CO5:** Understanding the multiprocessors systems.

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## Course Contents

### UNIT-I

**No. of Hours: 8**

Basic Components of Computer, Von Neumann Architecture, I/O Devices. Logic Gates, Truth Tables, Boolean Algebra, Digital Circuits, Combinational Circuits, Introduction to Sequential Circuits, Tables, Excitation Table.

### UNIT-II

**No. of Hours: 8**

Number System, Complements, Data Representation, Designing of Combinational Circuits- Half Adder, Full Adder, Decoders, Encoders, Multiplexers, Registers and Memory, Arithmetic operations, Adder- Subtractor.

### UNIT-III

**No. of Hours: 8**

Circuit Simplification using Karnaugh Map, Don't Care Conditions, Flip-Flops, Characteristic, Bus Organization, Microprogrammed vs Hardwired Control, Stored Program Organisation, Instruction Codes, Instruction Format, Instruction Cycle, Instruction types, Input Output Instructions, Program Interrupt.

### UNIT-IV

**No. of Hours: 8**

General Register and Stack Organization, Addressing Modes, RISC, CISC, Complete Computer Description, Design of Basic Computer, Programming the basic Computer, Rules, Subroutines, I/O Programming.

### UNIT-V

**No. of Hours: 8**

Parallel Processing, Pipelining, Vector Processing, Memory hierarchy and Organisation, Multiprocessor Characteristics, Interprocessor Communications, Mutual exclusion with a Semaphore.

### Text Books:

1. Computer System Architecture, Mano M , Pearson Education.

### Reference Books:

1. Digital Design, Mano, M, Pearson Education.

2. Computer Organization and Architecture Designing for Performance Stallings, W, Prentice Hall of India.

**Online Resources:**

1. [https://onlinecourses.nptel.ac.in/noc25\\_cs01/preview](https://onlinecourses.nptel.ac.in/noc25_cs01/preview).

## CS-3027: COMPUTER SYSTEM ARCHITECTURE- PRACTICAL

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### Course Outcomes (COs):

**CO1:** To understand computer architecture.

**CO2:** To understand concepts of numbering systems.

**CO3:** Understanding the various I/O devices.

**CO4:** Understanding with assembly language instruction format.

**CO5:** To understand the functioning of multiprocessors systems.

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### Course Contents

#### UNIT-I

**No. of Hours: 4**

Experiments on understanding of various Logic Gates, Truth Tables.

#### UNIT-II

**No. of Hours: 4**

Practising Number System conversion using programming language.

Experimenting with Half Adder, Full Adder, Decoders, Encoders, Multiplexers.

#### UNIT-III

**No. of Hours: 4**

Experimenting to understand various Flip-Flops and Characteristic. Experimenting with basic Instruction codes.

#### UNIT-IV

**No. of Hours: 4**

Programing to use Interrupt.

#### UNIT-V

**No. of Hours: 4**

Experimenting to understand various I/O devices and processors.

#### Text Books:

1. Computer System Architecture, Mano M, Pearson Education.

#### Reference Books:

1. Digital Design, Mano, M, Pearson Education.

2. Computer Organization and Architecture Designing for Performance Stallings, W, Prentice Hall of India.

#### Online Resources:

1. [https://onlinecourses.nptel.ac.in/noc25\\_cs01/preview](https://onlinecourses.nptel.ac.in/noc25_cs01/preview).

## CS-3137: LINEAR ALGEBRA

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### Course Outcomes (COs):

- CO1:** Understand matrix algebra and its applications in computer graphics  
**CO2:** Analyze determinants, eigenvalues, and decompositions for solving problems.  
**CO3:** Explore vector spaces, linear independence, and basis for solving linear systems.  
**CO4:** Apply linear transformations to computational applications.  
**CO5:** Utilize inner product spaces and orthogonalization in practical scenarios.
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### Course Contents

#### UNIT-I

**No. of Hours: 8**

Linear Equations and Matrices: Systems of Linear Equations, Gaussian Elimination, Vector Arithmetic, Arithmetic of Matrices, Matrix Algebra, The Transpose and Inverse of a Matrix, Types of Solutions, The Inverse Matrix Method, Application to Computer graphics.

#### UNIT-II

**No. of Hours: 8**

Determinants and the Inverse Matrix: Determinant of a Matrix, Determinant of Other Matrices, Properties of Determinants, LU Factorization. Eigenvalues and Eigenvectors: Diagonalization, Diagonalization of Symmetric Matrices, Singular Value Decomposition, Application to Differential Equations.

#### UNIT-III

**No. of Hours: 8**

Euclidean Space: Properties of Vectors, Further Properties of Vectors, Linear Independence, Basis and Spanning Set. General Vector Spaces: Introduction to General Vector Spaces, Subspace of a Vector Space, Linear Independence and Basis, Dimension, Properties of a Matrix, Linear Systems Revisited.

#### UNIT-IV

**No. of Hours: 8**

Linear Transformations: Introduction to Linear Transformations, Kernel and Range of a Linear Transformation, Rank and Nullity, Inverse Linear Transformations, The Matrix of a Linear Transformation, Composition and Inverse Linear Transformations.

#### UNIT-V

**No. of Hours: 8**

Inner Product Spaces: Introduction to Inner Product Spaces: Definition, Example, properties, norm of a vector. Inequalities and Orthogonality: Orthogonal vectors, normalising vectors, orthonormal set. Orthonormal Bases: The Gram-schmidt process. Orthogonal Matrices: properties, QR factorization. Application of Inner Product Spaces.

#### Text Books:

1. Linear Algebra Step by Step, Kuldeep Singh, First Edition published by Oxford University Press, 2014.

2. Environment and Ecology: Author: Vaishali Anand

**Reference Books:**

1. Linear Algebra and its Applications, David C. Lay, Pearson 3rd Edition 2006.
2. Linear Algebra and its Applications, Gilbert Strang, Cengage Learning, 4th edition, 2006.

**Online Resources:**

## CS-3207: OBJECT ORIENTED PROGRAMMING THROUGH C++

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### Course Outcomes (COs):

**CO1:** Write maintainable and reusable C++ functions.

**CO2:** Understand the fundamentals of C++.

**CO3:** Understand the fundamentals of object-oriented programming.

**CO4:** Reuse standard template library containers.

**CO5:** Apply refactoring techniques to write clean and maintainable code.

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### Course Contents

#### UNIT-I

**No. of Hours: 8**

C++ Basics, Functions and Files, High Quality Functions, Defensive Programming, Recursion, Debugging C++ Programs, Fundamental Data Types, Constants and Strings, Operators, Scope, Duration, and Linkage, Control Flow, General Issues in Variables, The Power of Variable Names.

#### UNIT-II

**No. of Hours: 10**

Error Detection and Handling, Type Conversion, Type Aliases, and Type Deduction, Function Overloading and Function Templates, Compound Types: References and Pointers, Compound Types: Enums and Structs.

#### UNIT-III

**No. of Hours: 10**

Introduction to Object-Oriented Programming: Introduction to Classes, Class Templates, Dynamic arrays: `std::vector`, Fixed-size arrays: `std::array` and C-style arrays, Operator Overloading, Inheritance, Virtual Functions, Move Semantics and Smart Pointers, Exception Handling.

#### UNIT-IV

**No. of Hours: 6**

The Standard Template Library: Algorithms, Sequence Containers, Vectors, Lists, Iterators, Specialized Iterators, Associative Containers, Function objects.

#### UNIT-V

**No. of Hours: 6**

Code Improvements: Collaborative Construction, Pair Programming, Developer Testing, Bag of Testing Tricks, Debugging, Refactoring, Self Documenting Code, Code Tuning.

#### Text Books:

1. "A Tour of C++ ", by Bjarne Stroustrup Addison-Wesley Professional, 3rd Edition 2022.

#### Reference Books:

1. "Code Complete", by Steve McConnell, Microsoft Press, 2nd Edition 2011.

#### Online Resources:

1. Learn C++ – Skill up with our free tutorials ([learncpp.com](http://learncpp.com)).

# CS-3207: OBJECT ORIENTED PROGRAMMING THROUGH C++ - PRACTICAL

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## Course Outcomes (COs):

**CO1:** Write maintainable and reusable C++ functions.

**CO2:** Understand the fundamentals of C++.

**CO3:** Understand the fundamentals of object-oriented programming.

**CO4:** Reuse standard template library containers.

**CO5:** Apply refactoring techniques to write clean and maintainable code.

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## Course Contents

### UNIT-I

**No. of Hours: 8**

1. Implement sequential search function using C++.
2. Implement binary search function using C++

### UNIT-II

**No. of Hours: 8**

1. Implement a recursive function to compute factorial of a given integer.
2. Implement a function to solve 2-sum problem.

### UNIT-III

**No. of Hours: 8**

1. Implement a class to create programmer defined type for complex numbers.
2. Implement a class to create programmer defined type for a matrix.

### UNIT-IV

**No. of Hours: 8**

1. Implement Quicksort and provide an implementation which removes recursion.
2. Implement a class to create programmer defined type for a string.

### UNIT-V

**No. of Hours: 8**

1. Implement a class to provide a type for stack of integers.
2. Implement a generic class to provide a stack.

### Text Books:

1. "A Tour of C++ ", by Bjarne Stroustrup Addison-Wesley Professional, 3rd Edition 2022.

### Reference Books:

1. "Code Complete", by Steve McConnell, Microsoft Press, 2nd Edition 2011.

### Online Resources:

1. Learn C++ – Skill up with our free tutorials ([learncpp.com](http://learncpp.com)).

## CS-5511: OPERATING SYSTEMS

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### Course Outcomes (COs):

**CO1:** Understand fundamentals of operating system.

**CO2:** Analyze Process Management and evaluate processor scheduling and algorithms.

**CO3:** Study deadlock handling and inter-process communication techniques.

**CO4:** Demonstrate file systems and understand device management.

**CO5:** Explain and implement memory management techniques, including paging, segmentation, and virtual memory

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### Course Contents

#### UNIT-I

**No. of Hours: 8**

Introduction to Operating System: Definition and purpose of Operating system, functions of OS. Evolution of operating system, Concepts of batch processing, multiprogrammed batched system, time-sharing systems, Multiprocessor Operating Systems, Network Systems, Distributed Computing. System calls.

#### UNIT-II

**No. of Hours: 8**

Process Management: Process concept, Process states, Process Control Block, Context Switching, Process scheduling, Multithreading and its benefits.  
CPU scheduling: Scheduling criteria and algorithms (FCFS, SJF, Priority, Round-Robin, Multi-level Queue. Comparison and performance evaluation.

#### UNIT-III

**No. of Hours: 8**

Memory management: Primary and secondary memory, Cache memory. Contiguous, allocation and its drawbacks, Non-contiguous allocation. Address translation process, Logical and physical address spaces, paging and segmentation. Virtual memory: - Demand paging and its need, Performance of demand paging, Page replacement (FIFO, LRU, Optimal), Thrashing, Principle of locality.

#### UNIT-IV

**No. of Hours: 8**

Process synchronization & IPC: Co-operating processes and IPC, Critical section problem, Mutual exclusion and synchronization, Concept of semaphores, Classical IPC problems. Deadlocks handling: prevention, avoidance, Banker's Algorithm, Detection and Recovery from deadlock.

#### UNIT-V

**No. of Hours: 8**

File system: - File concept, access methods, Directory structure, protection and consistency. File system structure, Allocation methods, Free space management, protection and sharing. I/O system: Various I/O devices, Device drivers, structure of I/O software, Transforming I/O request of h/w operation. Secondary storage structure: Disk structure, DMA, Disk Scheduling Algorithms. Case study of Windows/Unix operating system.

**Text Books:**

1. Silberschatz, Gagne, Galvin, Operating Systemconcept, 8th edition, WILEY.
2. Andrew S.Tanenbaum, 3rdedition, Modern Operating Systems, Pearson.

**Reference Books:**

1. Sumitabha Das, Fourth /edition, Unix Concepts and Applications, Mc Graw Hill.

**Online Resources:**

# CS-5511: OPERATING SYSTEMS - PRACTICAL

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## Course Outcomes (COs):

**CO1:** Utilize MS Office tools and understand the basics, functions, and services of operating systems.

**CO2:** Differentiate types of operating systems and analyze process management concepts.

**CO3:** Explain CPU scheduling techniques and simulate the role of schedulers and dispatchers.

**CO4:** Implement and evaluate various CPU scheduling algorithms for performance optimization.

**CO5:** Apply memory and disk management techniques, including fragmentation and disk scheduling algorithms.

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## Course Contents

### UNIT-I

**No. of Hours: 4**

Introduction to MS Office Tools and Operating System Basics:

1. MS Word Practical:
  - Create a formatted document with a table of contents, headers, footers, and page numbers.
  - Design a resume using templates and advanced formatting tools.
2. MS Excel Practical:
  - Create a spreadsheet to calculate student grades using formulas and functions (e.g., SUM, AVERAGE, IF).
  - Design a sales report using charts and conditional formatting.
3. MS PowerPoint Practical:
  - Develop a presentation on a topic with animations, transitions, and embedded media.
4. Operating System Basics:
  - Demonstrate operating system installation and configuration.
  - Explore OS services using basic commands.

### UNIT-II

**No. of Hours: 4**

Process Management and Operating Systems:

1. Exploring Operating System Types:
  - Compare the working of a time-sharing OS vs. a multitasking OS using simulation tools.
2. Process Management:
  - Simulate process states (new, ready, running, waiting, terminated) using process state diagrams.
  - Demonstrate the creation and termination of processes using shell scripting.
3. Process Control Block (PCB):
  - Design a simple PCB representation using a spreadsheet or a C/JAVA/Python program.

### UNIT-III

**No. of Hours: 6**

CPU Scheduling:

1. CPU Scheduling Concepts:
  - Create a program to simulate context switching among processes.
  - Write a program to identify the role of a dispatcher in process scheduling.
2. Scheduling Criteria:
  - Calculate scheduling criteria such as waiting time and turnaround time using a C/JAVA/Python program.

#### **UNIT-IV**

**No. of Hours: 6**

##### Scheduling Algorithms:

1. Non-Preemptive Scheduling:
  - Implement the First Come First Serve (FCFS) and Shortest Job First (SJF) scheduling algorithms.
2. Preemptive Scheduling:
  - Simulate Shortest Remaining Time First (SRTF) and Round Robin scheduling algorithms.
3. Comparison of Algorithms:
  - Write a program to compare and analyze the performance of different scheduling algorithms (e.g., average waiting time).

#### **UNIT-V**

**No. of Hours: 4**

##### Memory and Disk Management:

1. Memory Management:
  - Simulate fixed and variable memory partitioning.
  - Demonstrate internal and external fragmentation through visual tools or simulations.
2. Disk Management:
  - Write a program to simulate disk arm scheduling algorithms (e.g., FCFS, SSTF).
  - Analyze the performance of different disk scheduling algorithms in terms of seek time.
3. Practical Assignment:
  - Demonstrate a case study on memory and disk management in a real-world OS.

#### **Text Books:**

1. Operating Systems Concepts with Java - Abraham Silberschatz, Greg Gagne, Peter B. Galvin, Wiley, 6th Edition.
2. Working in Microsoft Office- Ron Mansfield, McGraw-Hill Osborne Media, 1st Edition.

#### **Reference Books:**

1. Modern Operating Systems: Andrew S. Tanenbaum, Prentice Hall, 3rd Edition.

#### **Online Resources:**

1. [https://onlinecourses.swayam2.ac.in/ntr25\\_ed41/preview](https://onlinecourses.swayam2.ac.in/ntr25_ed41/preview)
2. <https://www.cse.iitb.ac.in/~mythili/os/>
3. <https://cse.iitkgp.ac.in/~ksrao/caos2018files/OS-introduction.pdf>

## IC-2934: ENVIRONMENTAL SCIENCE

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### Course Outcomes (COs):

- CO1:** Basic knowledge of environment and its components.  
**CO2:** Ability to understand environmental degradation and ecosystem.  
**CO3:** Knowledge regarding environmental pollution and their effects to the world.  
**CO4:** Exposure to planning and management of environment.  
**CO5:** Knowledge regarding environmental policy, rules and regulations.
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### Course Contents

- UNIT-I** **No. of Hours: 4**  
Definition, Scope, structure and type of environment, components of environment, Society and resources. Man environment relationship: Approach to study man interaction with environment. Role of individual in environmental conservation. Segments of environment-lithosphere, hydrosphere, atmosphere and biosphere.
- UNIT-II** **No. of Hours: 4**  
Environmental degradation: Meaning of degradation, types of degradation, process of degradation, cause of degradation, Religious and philosophical factors, deforestation, agricultural development and degradation, population growth and degradation, urbanization and degradation, modern technology and degradation.
- UNIT-III** **No. of Hours: 8**  
Ecology: Definition of ecology and ecosystem. Types of ecosystem, components of ecosystem, functions of ecosystem, productivity and stability of ecosystem. Environmental disasters: Meaning and concepts, types of hazards and disaster, man induced and natural hazards, global warming, ozone depletion, green house effect and other major environmental problems. Concept of Biodiversity, definition and types, Bio-geographical classification of India; Value of biodiversity; Biodiversity at global, national and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity.
- UNIT-IV** **No. of Hours: 8**  
Environmental pollution: Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.
- UNIT-V** **No. of Hours: 8**

Sustainable development, urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental planning and management: Concepts, aspects and approaches, resources management, ecological management. Biosphere reserves, management of wild life. Environmental regulation and rules, Vision of Environment by govt. of India, Environmental policy, waste disposal rules and laws and legislation enacted by parliament for environmental protection. Environment Laws and Acts, Issues involved in enforcement of environmental legislation, Public awareness. Population growth, variation among nations.

**Text Books:**

1. Environmental Awareness: Dr. Dhananjay Verma, Published by: Madhya Pradesh Hindi Granth Academy.
2. Environment and Ecology: Author: Vaishali Anand

**Reference Books:**

**Online Resources:**