



# 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.

## III - SEMESTER

## CS-4405: Database Management System

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**Aim:**

Enable student to design database and information retrieval concepts and apply these concepts in complex projects involving large database.

**Course Outcomes (COs):**

- CO1:** Conceptual Clarity on database systems and their evolution.
- CO2:** Theoretical foundation of query languages through relational algebra.
- CO3:** Understand the database design issues from E-R model to Normalization.
- CO4:** Proficiency in SQL, PLSQL and NoSQL through Case Studies/Real Life Problems.
- CO5:** Exposure to advance topics like transaction management, concurrency control and physical data storage.

**Unit-I**

**No. of Hours: 8**

Introduction and Relational Model: Advantages of DBMS approach, various views of data, data independence, schema & sub-schema, primary concept of data models, database languages, transaction management, database administrator & user, data dictionary, database structure & architectures. Relational Model: Domains, relation, kind of relation, Relational databases, Various types of keys: candidate, primary, alternate & foreign keys, relational algebra with fundamental and extended operations, modification of database.

**Unit-II**

**No. of Hours: 12**

ER Model and SQL: Basic concept, design issues, mapping constraint, keys, ER diagram, weak & strong entity-sets, specialization & generalization, aggregation, inheritance, design of ER schema, Reduction of ER Schema to tables. SQL: Basic structure of SQL, Set operation, Aggregate functions, Null values, Nested Sub queries, derived relations, views, Modification of database, join relation, Domain, relation & keys, DDL in SQL, integrity rules, Domain rules, Attributes rules, assertion, integrity & SQL. Query Optimization. PL/SQL: Programming concepts, stored procedure, function, packages and triggers. Database connectivity with ODBC/JDBC 9.

**Unit-III**

**No. of Hours: 6**

Functional Dependencies: Basic definitions, Trivial & non trivial dependencies, closure set of dependencies & of attributes, Irreducible set of dependencies, FD diagram. Normalization: Introduction to normalization, non loss decomposition, First, second and third normal forms, dependency preservation, BCNF, Multivalued dependencies and fourth normal form, join dependencies and fifth normal form.

**Unit-IV**

**No. of Hours: 7**

Storage Structure & File Organization: Basic concept, RAID. File Organization. Basic concept of Indexing. Transaction Management: Basic concept, ACID properties, transaction state, Implementation of atomicity & durability, Concurrent execution, Basic idea of serializability. Concurrency & Recovery: Basic idea of concurrency control, Failure Classification, storage

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structure-types, stable storage implementation, data access, recovery & Atomicity: log based recovery, deferred database modification, immediate database modification, checkpoints.

### Unit-V

No. of Hours: 7

The concept of NoSQL, Brief history of NoSQL, SQL verses NoSQL, CAP Theorem (Brewer's Theorem), NoSQL pros/cons, Categories of NoSQL database, Production deployment, MongoDB, Key Features, practical with MongoDB.

### Text Books:

1. Database System concepts –Henry F. Korth , Tata McGraw Hill 6th Edition.
2. NoSQL Distilled- Pramod J. Sadalage, Martin Fowler, Addison-Wesley, 2013

### Reference Book(s):

1. Fundamentals of Database Systems, Elmasri R, Navathe S, Addison Wesley 6th Ed.
2. An introduction to database system-Bipin C. Desai
3. An introduction to Database System -C.J Date
4. SQL, PL/SQL The programming language of Oracle-Ivan Bayross

### Online Resources:

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs91](https://onlinecourses.nptel.ac.in/noc22_cs91)
2. [https://onlinecourses.swayam2.ac.in/cec19\\_cs05](https://onlinecourses.swayam2.ac.in/cec19_cs05)

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**Aim:** Enable students to design database and information retrieval concepts and apply these concepts in complex projects involving large databases.

**Course Outcomes (COs):**

**CO1:** Knowledge of SQL queries and relational algebra.

**CO2:** Apply normalization techniques for refining databases.

**CO3:** Construct triggers, procedures, functions, packages, and cursors using PL/SQL.

**CO4:** Construct a database for Case Study/ Real Life Problem.

**CO5:** Knowledge of MongoDB queries.

**Week-I & II**

**No. of Hours: 8**

**Oracle Installation.**

**Create relations based on the Banking transactions given below.**

1. Deposit (acc\_no, cust\_name, bname, amount, dep\_date)
2. Branch (bname, city)
3. Customer (cust\_name, city)
4. Borrow (loan\_no, cust\_name, bname, amount)

**Relation 1. DEPOSIT**

acc_no	cust_name	bname	amount	dep_date
100	Riya	VRCE	1000	1-mar-2005
101	Karan	Ajni	5000	4-jan-2006
102	Neha	Karolbagh	3500	17-nov-2005
104	Madhuri	Chandani	1200	17-dec-2006
105	Rohit	M.G road	3000	27-mar-2006
106	Aditi	Andheri	2000	31-mar-2006
107	Kabir	Virar	1000	5-sep-2005
108	Isha	Nehru place	5000	2-jul-2005
109	Veer	Powai	7000	10-aug-2005

**Relation 2 BRANCH**

<b>bname</b>	<b>City</b>
VRCE	Nagpur
Ajni	Nagpur
Karolbagh	Delhi
Chandani	Delhi
Dharmpheth	Nagpur
M.G road	Banglore
Andheri	Mumbai
Virar	Mumbai
Nehru place	Delhi
Powai	Mumbai

**Relation 3 CUSTOMER**

<b>cust_name</b>	<b>City</b>
Riya	Kolkata
Karan	Delhi
Neha	Baroda
Aryan	Patna
Tanvi	Nagpur
Rohit	Nagpur
Aditi	Surat
Kabir	Mumbai
Isha	Mumbai
Veer	Mumbai

**Relation 4 BORROW**

<b>loan_no</b>	<b>cust_name</b>	<b>bname</b>	<b>Amount</b>
201	Riya	VRCE	1000
206	Neha	Ajni	4000
311	Karan	Dharampeth	3000
321	Madhuri	Andheri	2000
375	Rohit	Virar	8000
481	Isha	Nehru place	3000

**Selecting Data from Single Relation**

1. List all the data from the relation deposit.
2. List all the data from the relation borrow.
3. List all the data from customer relation.
4. List all the data from the relation branch.
5. Give the account no. and amount of depositors.
6. Give the cust\_name and account no. of depositors.
7. Give names of customers.
8. Give names of branches.
9. Give names of borrowers
10. Give the names of customers living in the city of Nagpur.
11. Give the names of depositors having an amount greater than 4000.
12. Give the account date of customer Riya.
13. Give the names of all branches located in city of Mumbai.
14. Give names of borrowers having loan no. 206.
15. Give the names of depositors having account at VCRE.
16. Give names of all branches located in Delhi.
17. Give the account number and deposit amount of the customer having an account opened between 1-12-2005 and 1-6-2005.
18. Give details of customer Riya.
19. Give the name of the city where Karolbagh branch is located.

**Week-III & IV**

**No. of Hours: 8**

**Queries related to JOIN and Cartesian Product:**

1. Give name of customer having living city Mumbai and branch city Delhi.
2. Give name of customers having same living city as their branch city.
3. Give names of customers who are borrowers as well as depositors and having living city Nagpur.
4. Give names of customers who are depositors and having the same branch city as that of Karan.
5. Give the names of depositors having the same city as that of Kabir and having deposit amount greater than 2000.
6. Give the names of borrowers having deposit amount greater than 1000 and the loan amount greater than 2000.
7. Give names of depositors having the same branch as the branch of Karan.
8. Give names of borrowers having loan amount greater than the loan amount of Riya.

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9. Give the names of customers living city where branch of depositor Karan is located.
10. Give loan no and the loan amount of borrower having the same branch as that of depositor Karan.
11. Give loan no., loan amount, account no, and deposit amount of customers living in city Nagpur.
12. Give loan no., loan amount , account no., and deposit amount of customers having a deposit branch located in Delhi
13. Give loan no., loan amount, account no., deposit amount, branch name, branch city, and living city of Rohit.
14. Give deposit details and loan details of the customer in the city where Rohit is living.
15. Give names of depositors having the same branch city as that of Karan and having the same living city as that of Riya.
16. Give names of depositors having an amount greater than 1000 and having the same living city as Rohit.
17. Give city of customer having the same branch city as that of Rohit.
18. Give branch city and living city of Rohit.
19. Give branch city of Karan or branch city of Riya.
20. Give the living city of Riya and living city of Karan.

### Set operations

1. List all the customers who are depositors but not borrowers.
2. List all the customers who are both depositors and borrowers.
3. List all the customers, along with their amount, who are either borrowers or depositors and living in city Nagpur.
4. List all the depositors having in all the branches where Karan is having account.
5. List all the customers living in city Nagpur and having branch city Mumbai or Delhi.
6. List all the depositors living in city Nagpur.
7. List all the depositors living in city Nagpur and having branch in city Delhi.
8. List the branch cities of Riya and Karan.
9. List the borrowers having branch city same as that of Karan.
10. List the customer having deposit greater than 1000 and loan less than 10000.
11. List the depositors having the same living city as that of Karan and the same branch city as that of Riya.
12. List the depositors having amount less than 8000 and living in the same city as Kabir.
13. List all the customers who are both depositors and borrowers and living in the same city as Riya.
14. List all the customer names and the amount for depositors living in the city where either Riya or Karan is living.
15. List the amount for the depositors living in the city where Riya is living.

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16. List the cities which are either branch city of Riya or living city of Karan.
17. List the customers who are borrowers and depositors and having living city Mumbai and branch city same as that of Aditi.
18. List the customers who are both borrowers and depositors and having the same branch city as that of Riya.

### Week-V & VI

No. of Hours: 8

1. List total loan amount.
2. List total deposit amount.
3. List total loan taken from Andheri branch.
4. List total deposit of customer having account date later than 1-Jan-2006.
5. List total deposit of customers living in city Nagpur.
6. List maximum deposit of customer living in Mumbai.
7. List total deposit of customers having branch city Delhi.
8. List total deposit of customers living in the city where Karan is living.
9. Count total number of branch cities.
10. Count total number of customer cities.
11. Give branch name and branch-wise deposit.
12. Give city name and city wise deposit.
13. Give city wise name and branch wise deposit.
14. Give the branch wise deposit of customer after account date 1-jan -2006.
15. Give branch wise loan of customer living in Nagpur.
16. Count total no. of customers.
17. Count total no. of depositor branch-wise.
18. Give maximum loan from branch VRCE.
19. Give living city wise loan of borrowers.
20. Give the number of customers who are depositor as well as borrowers.

### Group by and Having Clause

1. List the branches having sum of deposit more than 4000.
2. List the branches having a sum deposit more than 1000 and location in city Mumbai.
3. List the names of customers having deposit in the branches where the average deposit is more than 1000.
4. List the name of customers having maximum deposit.
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6. List the name of customers having maximum deposit in the customers living in Nagpur.
7. List the name of branch having highest number of depositors.
8. Count the number of depositors living in Nagpur.
9. Give the name of customers in Powai branch having more deposit than all customer VRCE branch.

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10. Give names of customers in Karolbagh branch having more deposit than any other in Virar branch.
11. Give names of customers having highest deposit in the branch where Karan is having deposit.
12. Give the highest deposit of the city where branch of Karan is located.
13. Give names of customers having more deposit than the average deposit in their respective branches.
14. Give names of customers having maximum deposit among deposits of Nagpur for branch VRCE.
15. Give the name of branch where name of depositors is less than 2.
16. Give name and city having more customers living in than Nagpur.
17. Give names of branches having the number of depositors more than the number of borrowers.
18. Give the names of customers living in the city where the maximum numbers of depositors are located.
19. Give the names of borrowers having the same branch city and highest borrower.
20. Count the number of customers living in the city where branch is located.

### Week-VII & VIII

No. of Hours: 8

1. Give 10% interest to all depositors.
2. Give 10% interest to all depositors having branch vrce.
3. Give 10% interest to all depositors living in Nagpur.
4. Give 10% interest to all depositors living in Nagpur and having branch in city Mumbai.
5. Add hundred rupees to the deposit of Riya and assign it to Karan.
6. Change the deposit of VCRE branch to 1000 and change the branch as VCRE\_Ambhazari.
7. Assign to all deposit of Riya the maximum deposit from VRCE branch.
8. Change the living city of VRCE branch borrowers to Nagpur.
9. Update deposit of Riya give him maximum deposit from depositors in living city Nagpur.
10. Deposit the sum of the deposits of Karan and Vijay in an account of Riya.
11. Transfer Rs 100 from the account of Riya to the account of Karan.
12. Transfer Rs 200 from the account of Riya to the account of Karan if both are having the same branch.
13. Delete from customer.
14. Delete depositors of branches having number of customer between 1 and 3.
15. Transfer Rs 120 from the account of Madhuri to the account of Rohit.
16. Delete branches having average deposit less than 5000.
17. Delete branches having maximum loan more than 5000.
18. Delete branches having deposit from Nagpur.
19. Delete deposit of Riya and Karan if both are having branch Virar.
20. Delete deposit of Riya and Karan if both are having living city Nagpur.

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21. Delete deposit of Riya and Karan if both are having same living city.
22. Delete deposit of Riya and Karan if they are having less deposit than Vijay.
23. Delete deposit of Ajay if Vijay is not a depositor.
24. Delete customer from Mumbai city.
25. Delete depositors if the branch is Virar and depositor name is Ajay.
26. Delete depositors having deposit less than 400.
27. Delete borrower having loan more than 10000 and branch Karolbagh.
28. Delete the names of those depositors of VRCE branch who live in the city Mumbai.
29. Delete borrower of branches having average loan less than 1000.
30. Delete borrower of branches having the minimum number of customers.

### Week- IX & X

No. of Hours: 8

1. Simple programs using loop, while, and for iterative control statements.
2. PLSQL code to print the Fibonacci series
3. Write a program to check whether the given number is Armstrong or not
4. Find the area and circumference of a circle.
5. Create a procedure to update the salaries of all employees as per the data provided by the student.
6. Demonstrate cursor.
7. Demonstrate trigger.
8. **CASE STUDY:** Relational Database for a University Course Management System

A group of final-year Computer Science undergraduate students were assigned a project to develop a database for managing courses, students, faculty, and grades within a university. The objective was to design and implement a normalized relational database schema which supports CRUD operations, reporting, and user access control. And also design an ER model on the basis of these relations. Ensure data consistency by storing information on students, faculty, courses, departments, and grades, with relationships maintained through foreign key constraints.

#### Key Entities:

- **Student** (student\_id, name, dob, department\_id)
- **Faculty** (faculty\_id, name, email, dept\_id)
- **Course** (course\_id, title, credits, dept\_id)
- **Enrollment** (student\_id, course\_id, semester, grade)
- **Department** (dept\_id, dept\_name)

#### 9. Perform queries on MongoDB

- Create table on the basis of above data shown (student, faculty, course, enrolment, department) on mongodb.
- Find all students who belong to a specific department.
- Retrieve students who have a GPA greater than 8.5.
- Count the number of students in each department.
- Add a new course to a student's courses array

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### Text Books:

1. NoSQL Distilled- Pramod J. Sadalage, Martin Fowler, Addison-Wesley, 2013
2. SQL, PL/SQL The programming language of Oracle-Ivan Bayross

### Reference Book(s):

1. Oracle Database 10g: The Complete reference, Kevin Loney.

### Online Resources:

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs91](https://onlinecourses.nptel.ac.in/noc22_cs91)
2. [https://onlinecourses.swayam2.ac.in/cec19\\_cs05](https://onlinecourses.swayam2.ac.in/cec19_cs05)

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## CS-2222: Data Structures and Algorithms

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**Aim:** To understand and develop different data structures and apply this knowledge for better programming design.

### Course Outcomes (COs)

**CO1:** Adequate knowledge to understand various linear and nonlinear data structures.

**CO2:** Know the strengths and weaknesses of different data structures.

**CO3:** Identify and build appropriate data structures for various real-world challenges.

**CO4:** Understanding of algorithm complexity analysis.

**CO5:** Design various searching and sorting algorithms.

### Unit-I:

**No. of Hours: 8**

Data structures: Definition & Classification, Abstract data type, Concept of Algorithm analysis, Time and Space Complexity. Arrays: Definition, representation of one and two-dimensional arrays, operations on Arrays.

### Unit-II:

**No. of Hours: 8**

Stacks: Definition, Implementation. Applications of Stack, Infix to Postfix Conversion. Queues: Operations on Queues, Queue Applications, Circular Queue, Double-ended Queue.

### Unit-III:

**No. of Hours: 8**

Singly Linked List: Implementation and Applications, Representation of a Polynomial, Polynomial Addition; Circular Linked List: Implementation and Applications, Doubly Linked List: Implementation and Applications.

### Unit-IV:

**No. of Hours: 8**

Introduction to Trees, Binary Tree, Tree Traversals: Preorder, Inorder and Postorder, Binary Search Tree. Graph: Definition of Undirected Graph and Directed Graph, Graph Representation. Graph Traversal: Breadth-first Traversal, Depth-first Traversal.

### Unit-V:

**No. of Hours: 8**

Searching algorithms: Linear Search and Binary Search, Hashing: Hash Functions, Collision Resolution. Sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, and Heap Sort.

### Text Books:

1. Text Books: 1. Data Structures using C and C++ by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub, 6th Edition.
2. Data Structures Using C by E Balagurusami, McGraw Hill Education on first edition

### Reference Book(s):

1. Theory & Problems of Data Structures by Jr. Seymour Lipschetz, Schaum's outline by TMH 2006, Special Indian Edition.
2. Data Structures and Algorithms by A.V. Aho, J.E. Hopcro and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low-priced edition.

## **School of Computer Science & Information Technology, DAVV, Indore**

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.

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## CS-2222: Data Structures and Algorithms - Practical

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### Aim:

### Course Outcomes (COs):

**CO1:** Implement fundamental linear data structures, including arrays, stacks, queues, and linked lists.

**CO2:** Construct and apply algorithms for the creation, traversal, and searching of tree data structure.

**CO3:** Design and implement various searching and sorting techniques to manipulate and organize data efficiently.

**CO4:** Evaluate and compare the performance of different data structures and algorithms in terms of time and space complexity.

**CO5:** Develop solutions to real-world problems by selecting and applying suitable data structures and algorithmic strategies.

### Unit-I

**No. of Hours: 4**

1. Write a C/ C++ program to create an array of 10 elements and print all the elements.
2. Write a C/ C++ program to print the sum of n given numbers.
3. Write a C/ C++ program to insert an element at any location in the given array.
4. Write a C/ C++ program to delete an element from any location of the given array.
5. Write a C/ C++ program to search an element from the given array and print the array index of that element.
6. Write a C/ C++ program to perform addition of two ( $n \times n$ ) matrices.
7. Write a C/ C++ program to perform subtraction of two matrices.

### Unit-II

**No. of Hours: 4**

1. Write a C/ C++ program to implement stack that perform the following operations:  
**a. Push    b. Pop    c. Display**  
The program should print appropriate messages for stack overflow and stack underflow.
2. Write a C/ C++ program to implement the working of a queue of integers using an array that perform the following operations:  
**a. Insert    b. Delete    c. Display**
3. Write a C/ C++ program for circular queue of integers using an array that perform the following operations:  
**a. Insert    b. Delete    c. Display**

### Unit-III

**No. of Hours: 16**

1. Write a C/ C++ program to construct a singly linked list and to perform the following operations on it:  
**a. Insertion operation at the beginning, end and at any given position of the list.**  
**b. Deletion operation from beginning, end and from any given position of the list.**  
**c. Traverse the list**
2. Write a C/ C++ program to implement a stack of integers using singly linked list.

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3. Write a C/ C++ program to implement a queue of integers using singly linked list.
4. Write a C/ C++ program to construct a doubly linked list and to perform the following operations on it:
  - a. Insertion operation at the beginning, end and at any given position of the list.
  - b. Deletion operation from beginning, end and from any given position of the list.
  - c. Traverse the list
5. Write a C/ C++ Program to construct a circular (Singly & Doubly) linked list and to perform the following operations on it:
  - a. Insertion operation at the beginning, end and at any given position of the list.
  - b. Deletion operation from beginning, end and from any given position of the list.
  - c. Display all the nodes of the list
6. Write a program to create and display a polynomial using linked list.
7. Write a program to implement deque using linked list.
8. Write a program to print the middle element of a given linked list if here is an odd number of elements in list.
9. Write a program to count the number of nodes of a given linked list (singly/ doubly/ circular).
10. Write a program to search a particular data in a singly linked list.
11. Write a program to replace the value of  $n^{\text{th}}$  node of a singly/ doubly/ circular list with the given value.

### Unit-IV

No. of Hours: 4

1. Write a program to construct a binary search tree of integers.
2. Write a program to implement the tree traversal methods.

### Unit-V

No. of Hours: 12

1. Write a program to implement linear search on a given list of integers.
2. Write a program to implement binary search on a given list of integers.
3. Write programs that implement various sorting methods to sort a given list of integers in ascending order.

### Text Books:

- Data Structures using C and C++ by A. M. Tenenbaum, Y. Langsam, M. J. Augenstein, Pearson Education, 2<sup>nd</sup> Edition.
- Data Structures using C by E Balagurusami, McGraw Hill, 2<sup>nd</sup> Edition.

### Reference Book(s):

- Theory & Problems of Data Structures, Schaum's outline Series, Seymour Lipschutz, Tmh 1986, McGraw Hills.
- Data Structures and Algorithms by A. V. Aho, J.E. Hopcroft and J. D. Ullman, Addison-Wesley Series in Computer Science and Information Pr, Pearson, 1<sup>st</sup> Edition.
- Fundamentals of Data structures in C++ by Horowitz, Sartaj Sahni, Mehta Silicon Pr, 1st Edition.

### Online Resources:

- <https://swayam.gov.in/>
- <https://nptel.ac.in/>

## CS-2133: Statistics and Probability

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**Aim:** To make students aware of the basic concepts of statistical and probability methods for data analysis.

### Course Outcomes (COs)

**CO1:** Students will learn about simple methods of statistics.

**CO2:** Students will be familiar with measures of Central tendency and dispersion.

**CO3:** Students will be able to evaluate the probabilities and conditional probability.

**CO4:** Students will learn about theoretical probability distribution and the curve fitting method.

**CO5:** Students will learn about regression, correlation, and the concept of hypothesis.

### Unit-I:

**No. of Hours: 8**

Measures of central tendency: Arithmetic Mean, Median, and Mode. Geometric mean, Harmonic Mean, and Partition values. Measures of dispersion: Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, and Coefficient of Dispersion.

### Unit-II:

**No. of Hours: 8**

Skewness, Kurtosis, Moments, Measure of skewness and kurtosis. Theory of probability: Introduction and definition of Probability, Event, Sample Space, Law of addition and multiplication of Probabilities and Conditional Probability. Independent and Dependent events, Bayes' theorem, Mathematical Expectations, and Moment generating functions.

### Unit-III:

**No. of Hours: 8**

Theoretical Distribution: Discrete Distribution- Binomial Distribution and Poisson Distribution. Continuous Distribution –Rectangular and Normal Distribution. Curve fitting: Curve fitting and Methods of Least Squares, Fitting a Straight Line and a Parabola.

### Unit-IV:

**No. of Hours: 8**

Correlation and Regression: Correlation, Coefficient of Correlation, Rank Correlation, Lines of Regression. Multiple and Partial Correlation.

### Unit-V:

**No. of Hours: 8**

Testing of hypothesis: Null and Alternative hypothesis, two types of errors, level of significance, and power of the test. Tests of significance.

### Text Books:

1. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics". 10th Edition, Publisher: Sultan Chand, 2000.

### Reference Book(s):

1. D.N.Elhance.-'Fundamentals of Mathematical Statisticcs' Kitab Mahal, Allahabad
2. A.M.Goon, M.K.Gupta & B. Dasgupta (1980): An outline of Statistical theory, Vol. I, 6th revised edition, World Press.
3. J.K. Sharma, "Business Sta s cs" second edition, Pearson

## CS-5702: Digital Signal Processing

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### Aim:

To provide a strong theoretical foundation in Digital Signal Processing and to develop practical skills for applying these techniques to solve specific challenges, particularly in cybersecurity.

### Course Outcomes (COs):

**CO1:** To introduce fundamental concepts of digital signal processing.

**CO2:** To understand how signals are generated, transformed, and analyzed in various cybersecurity contexts (network traffic, system logs, audio/visual data, sensor data).

**CO3:** To gain proficiency in frequency domain analysis techniques, including DFT and FFT.

**CO4:** To master the analysis and design of digital filters (FIR and IIR).

**CO5:** To explore real-world applications of DSP across various engineering and scientific domains.

### Unit-I

**No. of Hours: 5**

**Introduction to Digital Signals and Systems :-** Signals and Their Classification: Analog vs. Digital signals, Continuous-time vs. Discrete-time signals, Periodic vs. Aperiodic signals, Energy and Power signals. Discrete-Time Signals: Basic sequences (unit impulse, unit step, exponential, sinusoidal) Discrete-Time Systems: Linear Time-Invariant (LTI) systems, causality, stability.

### Unit-II

**No. of Hours: 3**

**Sampling and Quantization:-** Nyquist-Shannon sampling theorem, aliasing, quantization error, A/D and D/A conversion. Reconstruction of analog signals from samples, signal-to-quantization noise ratio (SQNR).

### Unit-III

**No. of Hours: 4**

**Frequency Domain Analysis:-** Fourier Series and Fourier Transform (Continuous and Discrete): Understanding the frequency content of signals. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Efficient computation of frequency components. Spectral Analysis: Power Spectral Density (PSD) estimation.

### Unit-IV

**No. of Hours: 4**

**Introduction to Filters:** Low-pass, high-pass, band-pass, band-stop filters. Linear Phase Filters: Importance in signal integrity. Finite Impulse Response (FIR) Filters: Design methods (windowing, frequency sampling). Applications: Noise reduction, signal enhancement.

### Unit-V

**No. of Hours: 4**

**DSP Applications and Implementations:** Audio processing: Speech recognition/synthesis basics, audio effects, noise reduction. Image processing: Image enhancement, filtering, compression fundamentals (e.g., JPEG basic)  
Telecommunications: Modulation/demodulation, channel equalization.

## School of Computer Science & Information Technology, DAVV, Indore

### Text Books:

1. G, Lyons Richard. Understanding Digital Signal Processing. Pearson Education India, 2011.
2. Oppenheim, Alan V., and Ronald W. Schafer. Discrete-Time Signal Processing: Pearson New International Edition. Pearson Higher Ed, 2013.

### Reference Book(s):

1. Proakis, John G., and Dimitris G. Manolakis. Digital Signal Processing: Principles, Algorithms, and Applications. 1996.
2. Karris, Steven T. Signals and Systems With MATLAB Computing and Simulink Modeling. Orchard Publications, 2007.

### Online Resources:

1. [https://onlinecourses.nptel.ac.in/noc24\\_ee16/preview](https://onlinecourses.nptel.ac.in/noc24_ee16/preview)

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