4. Write a program to sort the elements of an array using Radix Sort.
5. Write a program to sort the elements of an array using Bucket Sort.
6. Display the data stored in a given graph using the Breadth-First Search algorithm.
7. Display the data stored in a given graph using the Depth-First Search algorithm.
8. Write a program to determine a minimum spanning tree of a graph using the Prim's algorithm.
9. Write a program to implement Dijkstra's algorithm to find the shortest paths from a given source node to all other nodes in a graph.
10. Write a program to solve the weighted interval scheduling problem.
11. Write a program to solve the 0-1 knapsack problem.

For the algorithms at S.No 1 and 2, test run the algorithm on 100 different input sizes varying from 30 to 1000. For each size find the number of comparisons averaged on 10 different input instances; plot a graph for the average number of comparisons against each input size. Compare it with a graph of nlogn.

DISCIPLINE SPECIFIC CORE COURSE – 11 (DSC11): Database Management Systems

Credit distribution, Eligibility and Prerequisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC 11 Database Management Systems	**4**	**3**	**0**	**1**	Pass in Class XII	DSC01 Programming using Python / A course in Python at plus 2 level, DSC08

Learning Objectives

The course introduces the students to the fundamentals of database management system and its architecture. Emphasis is given on the popular relational database system including data models and data manipulation. Students will learn about the importance of database structure and its designing using conceptual approach using Entity Relationship Model and formal approach using Normalization. The importance of file indexing and controlled execution of transactions will be taught. The course would give students hands-on practice of structured query language in a relational database management system and glimpse of basic database administration commands.

Learning outcomes

On successful completion of the course, students will be able to:

- Use database management system software to create and manipulate the database.
- Create conceptual data models using entity relationship diagrams for modeling real-life situations and designing the database schema.
- Use the concept of functional dependencies to remove redundancy and update anomalies.
- Apply normalization theory to get a normalized database scheme.
- Write queries using relational algebra, a procedural language.

SYLLABUS OF DSC11

Unit 1 (5 hours)

Introduction to Database: Purpose of database system, Characteristics of database approach, data models, database management system, database system architecture, three-schema architecture, components of DBMS, data independence, and file system approach vs database system approach.

Unit 2 (7 hours)

Entity Relationship Modeling: Conceptual data modeling - motivation, entities, entity types, attributes, relationships, relationship types, constraints on relationship, Entity Relationship diagram notation.

Unit 3 (7 hours)

Relational Data Model: Update anomalies, Relational Data Model - Concept of relations, schema-instance distinction, keys, relational integrity constraints, referential integrity and foreign keys, relational algebra operators and queries.

Unit 4 (10 hours)

Structured Query Language (SQL): Querying in SQL, DDL to create database and tables, table constraints, update database-update behaviors, DML, aggregation functions group by

and having clauses, retrieve data from the database, generate and query views. Access and manipulate databases using ODBC. Basic Database administration SQL commands.

Unit 5 (8 hours)

Database Design: Mapping an Entity Relationship model to relational database, functional dependencies and Normal forms, 1NF, 2NF, 3NF and BCNF decompositions and desirable properties of them.

Unit 6 (8 hours)

File indexing and Transaction Processing: Data Storage and Indexes- Need of file indexes, file organizations, index structures, single- and multi-level indexing, concurrent execution of transactions, ACID properties, need of data recovery and log file.

Essential/recommended readings

1. Elmasri, R., Navathe, B. S. *Fundamentals of Database Systems*, 7th Edition, Pearson Education, 2015.
2. Krogh, J. W. *MySQL Connector/Python Revealed: SQL and NoSQL Data Storage Using MySQL for Python Programmers*, Apress, 2018.
3. Murach J. *Murach's MySQL,* 3rd edition, Pearson, 2019.

Additional References

1. Ramakrishnan, R., Gehrke J. *Database Management Systems*, 3rd Edition, McGraw-Hill, 2014.
2. Silberschatz, A., Korth, H. F., Sudarshan S. *Database System Concepts*, 7th Edition, McGraw Hill, 2019.
3. Connolly, T. M., Begg, C. E. *Database Systems: A Practical Approach to Design, Implementation, and Management*, 6th edition, Pearson, 2019.

Suggested Practical List (If any): (30 Hours)

Practical exercises such as

It has three components.

I. Create and use the following student-society database schema for a college to answer the given (sample) queries using the standalone SQL editor.

STUDENT	**Roll No**	**StudentName**	**Course**	**DOB**
	Char(6)	Varchar(20)	Varchar(10)	Date

SOCIETY	SID	SocName	MentorName	TotalSeats
	Char(6)	Varchar(20)	Varchar(15)	Unsigned int

ENROLLMENT	Roll No	SID	DateOfEnrollment
	Char(6)	Char(6)	Date

Here Rollno (ENROLLMENT) and SID (ENROLLMENT) are foreign keys.

1. Retrieve names of students enrolled in any society.
2. Retrieve all society names.
3. Retrieve students' names starting with letter ‘A’.
4. Retrieve students' details studying in courses ‘computer science’ or ‘chemistry’.
5. Retrieve students’ names whose roll no either starts with ‘X’ or ‘Z’ and ends with ‘9’
6. Find society details with more than N TotalSeats where N is to be input by the user
7. Update society table for mentor name of a specific society
8. Find society names in which more than five students have enrolled
9. Find the name of youngest student enrolled in society ‘NSS’
10. Find the name of most popular society (on the basis of enrolled students)
11. Find the name of two least popular societies (on the basis of enrolled students)
12. Find the student names who are not enrolled in any society
13. Find the student names enrolled in at least two societies
14. Find society names in which maximum students are enrolled
15. Find names of all students who have enrolled in any society and society names in which at least one student has enrolled
16. Find names of students who are enrolled in any of the three societies ‘Debating’, ‘Dancing’ and ‘Sashakt’.
17. Find society names such that its mentor has a name with ‘Gupta’ in it.
18. Find the society names in which the number of enrolled students is only 10% of its capacity.
19. Display the vacant seats for each society.
20. Increment Total Seats of each society by 10%
21. Add enrollment fees paid (‘yes’/’No’) field in the enrollment table.
22. Update date of enrollment of society id ‘s1’ to ‘2018-01-15’, ‘s2’ to current date and ‘s3’ to ‘2018-01-02’.
23. Create a view to keep track of society names with the total number of students enrolled in it.
24. Find student names enrolled in all the societies.
25. Count number of societies with more than 5 student enrolled in it
26. Add column Mobile number in student table with default value ‘9999999999’
27. Find the total number of students whose age is > 20 years.
28. Find names of students who are born in 2001 and are enrolled in at least one society.
29. Count all societies whose name starts with ‘S’ and ends with ‘t’ and at least 5 students are enrolled in the society.
30. Display the following information:

Society name Mentor name Total Capacity Total Enrolled Unfilled Seats

II. Do the following database administration commands:
create user, create role, grant privileges to a role, revoke privileges from a role, create index

II. Execute queries given in part I through a high-level language using ODBC connection.

DISCIPLINE SPECIFIC CORE COURSE– 12 (DSC-12): Computer Networks

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits				Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC12 Computer Networks	**4**	**3**	**0**	**1**	Pass in Class XII	DSC 04 Object Oriented Programming with C++/ GE 1a Programming using C++ / GE1b Programming with Python/ DSC 01 Programming using Python/ GE 3b: Java Programming

Learning Objectives
The course objectives of this paper are to:

- Understand the concepts behind computer networks and data communication.
- Learn the different types of networks, network topologies and their characteristics.
- Learn the working of protocols used at various layers.
- Understand the utility of different networking devices.

Learning outcomes

Upon successful completion of the course, students will be able to:

- differentiate between various types of computer networks and their topologies.
- understand the difference between the OSI and TCP/IP protocol suit.