

University of Engineering & Management, Jaipur

Syllabus for BSc Computer Science Admission Batch 2026

SEMESTER 4

S. No.	Subject Code	Subject Name	L	T	P	Total Contact Hrs	Credit Points
Theory							
1	BSCCS401	Design and Analysis of Algorithms	3	1	0	4	4
2	BSCCS402	Software Engineering	3	1	0	4	4
3	BSCCS403	Database Management Systems	3	1	0	4	4
4	BSCCS404	General Studies & Current Affairs -IV	3	1	0	4	4
Practical							
5	BSCCS491	Design and Analysis of Algorithms Lab	0	0	2	2	2
6	BSCCS492	Software Engineering Lab	0	0	2	2	2
7	BSCCS493	Database Management Systems Lab	0	0	2	2	2
Sessional							
8	BSCCS494	Web Design and Development	0	2	0	2	2
		Total	12	6	6	24	24

Subject Code: BS CCS401

Subject Name: Design and Analysis of Algorithms

Credit Points: 04

Course Objective:

This course is designed to introduce the students to design and analyze algorithms in terms of efficiency and correctness. The course focuses on highlighting difference between various problem solving techniques for efficient algorithm design.

Course Learning Outcomes:

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

1. Given an algorithm, identify the problem it solves.
2. Write algorithms choosing the best one or a combination of two or more of the algorithm design techniques: Iterative, divide-n-conquer, Greedy, Dynamic Programming using appropriate data structures.
3. Write proofs for correctness of algorithms.
4. Re-write a given algorithm replacing the (algorithm design) technique used with a more appropriate/efficient (algorithm design) technique.

Detailed Syllabus

Module 1

Algorithm Design Techniques: Iterative technique: Applications to Sorting and Searching (review), their correctness and analysis. Divide and Conquer: Application to Sorting and Searching (review of binary search), merge sort, quick sort, their correctness and analysis. Dynamic

Programming: Application to various problems (for reference; Weighted Interval Scheduling, Sequence Alignment, Knapsack), their correctness and analysis. Greedy Algorithms: Application to various problems, their correctness and analysis.

Module 2

More on Sorting and Searching: Heapsort, Lower Bounds using decision trees, sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Medians & Order Statistics, complexity analysis and their correctness.

Module 3

Advanced Analysis Technique: Amortized analysis

Module 4

Graphs: Graph Algorithms - Breadth First Search, Depth First Search and its Applications.

References

1. Kleinberg, J., & Tardos, E. (2013). Algorithm Design. 1st edition. Pearson Education India.

Additional Resources

1. Cormen, T.H., Leiserson, C.E. Rivest, R.L., & Stein, C. (2015). Introduction to Algorithms. 3rd edition. PHI.
2. Sarabasse & Gledler A. V. (1999). Computer Algorithm – Introduction to Design and Analysis. 3rd edition. Pearson Education

Subject Code: BSCCS491

Subject Name: Design and Analysis of Algorithms Lab

Credit Points: 02

Practical

1. a) Implement Insertion Sort (The program should report the number of comparisons)
b) Implement Merge Sort (The program should report the number of comparisons)
2. Implement Heap Sort (The program should report the number of comparisons)
3. Implement Randomized Quick sort (The program should report the number of comparisons)
4. Implement Radix Sort
5. Create a Red-Black Tree and perform following operations on it:
 - i. Insert a node
 - ii. Delete a node
 - iii. Search for a number & also report the color of the node containing this number.
6. Write a program to determine the LCS of two given sequences
7. Implement Breadth-First Search in a graph
8. Implement Depth-First Search in a graph
9. Write a program to determine the minimum spanning tree of a graph

For the algorithms at S.No 1 to 3 test run the algorithm on 100 different inputs of sizes varying from 30 to 1000. Count the number of comparisons and draw the graph. Compare it with a graph of $n \log n$.

Subject Code: BSCCS402

Subject Name: Software Engineering

Credit Points: 04

Course Objective

The course introduces fundamental Software Engineering approaches and techniques for software development. The students also develop a case study using appropriate software model.

Course Learning Outcomes

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

1. Analyse and model customer's requirements and model its software design.
2. Use suitable software model for the problem at hand.
3. Estimate cost and efforts required in building software.
4. Analyse and compute impact of various risks involved in software development.
5. Design and build test cases, and to perform software testing.

Detailed Syllabus**Module 1**

Introduction: Software Engineering - A Layered Approach; Software Process – Process Framework, Umbrella Activities; Process Models – Waterfall Model, Incremental Model, and Evolutionary process Model (Prototyping, Spiral Model); Introduction to Agile – Agility Principles, Agile Model – Scrum.

Module 2

Software Requirements Analysis and Specifications: Use Case Approach, Software Requirement Specification Document, Flow oriented Modeling, Data Flow Modeling, Sequence Diagrams

Module 3

Design Modeling: Translating the Requirements model into the Design Model, The Design Process, Design Concepts - Abstraction, Modularity and Functional Independence; Architectural Mapping using Data Flow.

Module 4

Software Metrics and Project Estimations: Function based Metrics, Software Measurement, Metrics for Software Quality; Software Project Estimation (FP based estimations, COCOMO II Model); Project Scheduling (Timeline charts, tracking the schedule).

Module 5

Quality Control and Risk Management: Quality Control and Quality Assurance, Software Process Assessment and Improvement Capability Maturity Model Integration (CMMI); Software Risks, Risk Identification, Risk Projection and Risk Refinement, Risk Mitigation, Monitoring and Management.

Module 6

Software Testing: Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, System Testing; Black-Box and White Box Testing, Basis Path Testing

References

1. Aggarwal, K. K., & Singh, Y. (2007). Software Engineering. 3rd edition. New Age International Publishers.
2. Pressman, R. S., & Maxim, B. R. (2015). Software Engineering: A Practitioner's Approach. 8th edition. McGraw-Hill.

Additional Resources

1. Jalote, P. (2005). An Integrated Approach to Software Engineering. 3rd edition. Narosa Publishing House.
2. Schwaber, K. & Sutherland, J. (2016). The Definitive Guide to Scrum: The Rules of the Game.
[<https://www.scrumguides.org/docs/scrumguide/v1/scrum-guide-us.pdf>]
3. Sommerville. (2011). Software Engineering. 9th edition. Addison Wesley.

Subject Code: BSCCS492

Subject Name: Software Engineering Lab

Credit Points: 02

Practical

Practical problems related to

1. Requirement Analysis, Creating a Data Flow, Data Dictionary, Use Cases
2. Computing FP, Effort, Schedule, Risk Table, Timeline chart
3. Design Engineering, Architectural Design, Data Design, Component Level Design
4. Testing, Basis Path Testing Sample Projects:
 1. Criminal Record Management: Implement a criminal record management system for jailers, police officers and CBI officers
 2. DTC Route Information: Online information about the bus routes and their frequency and fares
 3. Car Pooling: To maintain a web based intranet application that enables the corporate employees within an organization to avail the facility of carpooling effectively.
4. Patient Appointment and Prescription Management System
5. Organized Retail Shopping Management Software
6. Online Hotel Reservation Service System
7. Examination and Result computation system
8. Automatic Internal Assessment System
9. Parking Allocation System
10. Wholesale Management System

Subject Code: BSCCS403

Subject Name: Database Management Systems

Credit Points: 04

Course Objective

The course introduces the foundations of database management systems focusing on significance of a database, relational data model, schema creation and normalization, transaction processing, indexing, and the relevant data structures (files and B+-trees).

Course Learning Outcomes

On successful completion of the course, students will:

1. Describe major components of DBMS and their functions
2. Model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model.
3. Write queries in relational algebra / SQL
4. Normalize a given database schema to avoid data anomalies and data redundancy.
5. Describe the notions of indexes, views, constraints and transactions.

Detailed Syllabus

Module 1

Introduction to databases: Characteristics of database approach, data models, database system architecture, data independence and data abstraction.

Module 2

Data modeling: Entity relationship (ER) modeling: Entity types, relationships, constraints, ER diagrams, EER model

Module 3

Relation data model: Relational model concepts, relational constraints, relational algebra.

Module 4

SQL queries: SQL data definition, data types, specifying constraints, Queries for retrieval, insertion, deletion, updation, introduction to views.

Module 5

Database design: Mapping ER/EER model to relational database, functional dependencies, Lossless decomposition, Normal forms (upto BCNF).

Module 6

Transaction and data storage: Introduction to transaction processing: ACID properties, concurrency control; Introduction to indexing structures for files.

References

1. Elmasri, R., & Navathe, S.B. (2015). Fundamentals of Database Systems. 7th edition. Pearson Education.

Additional Resources

1. Date, C. J. (2004). An Introduction to database systems. 8th edition. Pearson Education.
2. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2010). Database System Concepts. 6th edition. McGrawHill.

Subject Code: BSCCS493

Subject Name: Database Management Systems Lab

Credit Points: 02

Practical

Create and use the following database schema to answer the given queries.

EMPLOYEE Schema

Field Type NULL KEY

DEFAULT

Empno Char(3) NO PRI NIL

Ename Varchar(50) NO NIL

Job_type Varchar(50) NO NIL

Manager Char(3) Yes FK NIL

Hire_date Date NO NIL

Dno Integer YES FK NIL

Commission Decimal(10,2) YES NIL

Salary Decimal(7,2) NO NIL

DEPARTMENT Schema

Field Type NULL KEY

DEFAULT

Dno Integer No PRI NULL

Dname Varchar(50) Yes NULL

Location Varchar(50) Yes New Delhi

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
3. Query to display the Employee Name concatenated by a Job separated by a comma.
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than \$2850.
6. Query to display Employee Name and Department Number for the Employee No= 7900.
7. Query to display Employee Name and Salary for all employees whose salary is not in the range of \$1500 and \$2850.
8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
9. Query to display Name and Hire Date of every Employee who was hired in 1981.

10. Query to display Name and Job of all employees who don't have a current Manager.
11. Query to display the Name, Salary and Commission for all the employees who earn commission.
12. Sort the data in descending order of Salary and Commission.
13. Query to display Name of all the employees where the third letter of their name is 'A'.
14. Query to display Name of all employees either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Manager's Employee No = 7788.
15. Query to display Name, Salary and Commission for all employees whose Commission amount is 14 greater than their Salary increased by 5%.
16. Query to display the Current Date.
17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
18. Query to display Name and calculate the number of months between today and the date each employee was hired.
19. Query to display the following for each employee <E-Name> earns <Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.
20. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.
21. Query to display Name, Hire Date and Day of the week on which the employee started.
22. Query to display Name, Department Name and Department No for all the employees.
23. Query to display Unique Listing of all Jobs that are in Department # 30.
24. Query to display Name, Dept Name of all employees who have an 'A' in their name.
25. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.
26. Query to display Name and Employee no. Along with their Manager's Name and the Manager's employee no; along with the Employees' Name who do not have a Manager.
27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies \$100.
29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees
30. Query to display the number of employees performing the same Job type functions.
31. Query to display the no. of managers without listing their names.
32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
33. Query to display Name and Hire Date for all employees in the same dept. as Blake.
34. Query to display the Employee No. And Name for all employees who earn more than the average salary.
35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.
36. Query to display the names and salaries of all employees who report to King.
37. Query to display the department no, name and job for all employees in the Sales department

Subject Code: BSCCS494

Subject Name: Web Design and development

Credit Points: 02

Practical

1. Practicals based on HTML
2. Practicals based on CSS
3. Practicals based on PHP
4. Practicals to create HTML forms
5. Practicals based on database connectivity with