Teaching Plan

Course: B.Sc.(Physical Sciences)
Semester-V
Subject: DSC-05: Database Management System

Learning Objectives

The course introduces the students to the fundamentals of database management system and its applications. Emphasis is given on the popular relational database system. Students will learn about the importance of database structure and its designing using Entity Relationship diagram and formal approach using normalization. Basic concepts of file indexing and transaction processing will be taught. The course would give students hands-on practice of structured query language to create, manipulate and implement a relational database.

Learning outcomes

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

- Use relational database management software to create and manipulate the database.
- Create conceptual data models using entity relationship diagrams for modeling real-life situations and map it to corresponding relational database schema.
- Use the concept of functional dependencies to remove redundancy and update anomalies.
- Apply normalization theory to get a normalized database scheme to get anomalies free database.

- Write queries in relational algebra.
- Implement relational databases and formulate queries for data retrieval and data update problems using SQL.
- Learn the importance of index structures and concurrent execution of transactions in database systems.

Week	Topic
Week 1	**UNIT – I** Introduction to Database: Database, characteristics of database approach, data models, database management system, three-schema architecture, components of DBMS
Week 2	**UNIT – I** Data independence, and file system approach vs database system approach. **UNIT-II** Entity Relationship Modeling: Conceptual data modeling - motivation, entities, entity types, attributes, relationships,
Week 3	**UNIT-II** Relationship types, constraints on relationship, Entity Relationship diagram as conceptual data model. **UNIT-III** Relational Data Model: Data anomalies, Relational Data Model - Characteristics of a relation, schema-instance distinction, types of keys
Week 4	**UNIT-III** Relational integrity constraints. Relational algebra operators like selection, projection, cartesian product, join and write queries using them. **(Assignment-1)**
Week 5	**UNIT-IV** Structured Query Language (SQL): DDL to create database and tables, table constraints, DML
Week 6	**UNIT-IV**

	Querying in SQL to retrieve data from the database **(Test-1)**
Week 7	**UNIT-IV** Aggregation functions group by and having clauses, generate and query views.
Week 8	**UNIT – V** Database Design: Mapping an Entity Relationship diagram to corresponding relational database scheme, **(Assignment-2)**
Week 9	**UNIT – V** Functional dependencies and Normal forms, 1NF
Week 10	**UNIT – V** 2NF, and 3NF decompositions and desirable properties of them.
Week 11	**UNIT – VI** File indexing and Transaction Processing: Need of file indexes, types of indexes
Week 12	**UNIT – VI** File organizations, single- and multi-level indexing, **(Test-2)**
Week 13	**UNIT – VI** Concurrent execution of transactions, ACID properties, need of data recovery.
Week 14	**Revision**

Essential/recommended readings

1. Elmasri, R., Navathe, B. S., Fundamentals of Database Systems, 7th edition, Pearson Education, 2016.
2. Murach, J., Murach's MySQL, 3th edition, Pearson, 2019.

Additional References

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

2019.

Suggested Practical List:

1. Retrieve names of students enrolled in any course.
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 course details with more than N students enrolled where N is to be input by the user
7. Update student table for modifying a student name.
8. Find course names in which more than five students have enrolled
9. Find the name of youngest student enrolled in course ‘BSc(P)CS’
10. Find the name of most popular society (on the basis of enrolled students)
11. Find the name of two popular part time courses (on the basis of enrolled students)
12. Find the student names who are admitted to full time courses only.
13. Find course names in which more than 30 students took admission
14. Find names of all students who took admission to any course and course names in which at least one student has enrolled
15. Find course names such that its teacher-in-charge has a name with ‘Gupta’ in it and the course is full time.
16. Find the course names in which the number of enrolled students is only 10% of its total seats.
17. Display the vacant seats for each course
18. Increment Total Seats of each course by 10%
19. Add enrollment fees paid (‘yes’/’No’) field in the enrollment table.
20. Update date of admission of all the courses by 1 year.
21. Create a view to keep track of course names with the total number of students enrolled in it.
22. Count the number of courses with more than 5 students enrolled for each type of course.
23. Add column Mobile number in student table with default value ‘9999999999’
24. Find the total number of students whose age is > 18 years.
25. Find names of students who are born in 2001 and are admitted to at least one part time course.
26. Count all courses having ‘science’ in the name and starting with the word ‘BSc’.

TEACHING PLAN

Course: All Courses
Semester-I/III/V
Subject: SEC: Analytics/ Computing with Python

Learning Objectives

The Learning Objectives of this course are as follows:

- To introduce machine learning techniques to students using Python programming
- To enable students to use various tools and and packages for advanced data analysis

Learning outcomes

The Learning Outcomes of this course are as follows:

- After studying this course, students will be able to learn about Python's main features and how they make Python a great tool for financial analysts.
- After studying this course, students will be able to get familiarized with Anaconda and Jupyter Notebook.
- After studying this course, students will be able to learn basics of Machine learning.
- After studying this course, students will be able to to apply these techniques on data.

Week	Topic
Week 1	Python: General overview, Python vs. Excel , Anaconda and Jupyter notebook: Interface overview, Data types in Python, Python basic syntax: Assignment statements, creating variables,
Week 2	Indentation, conditionals, and loops, writing user defined functions. Working with libraries: Pandas,
Week 3	NumPy
Week 4	Matplotlib,
Week 5	Seaborn.
Week 6	Python SQL Database Access: Introduction, Installation, DB Connection, Creating DB Table (Test-1)
Week 7	Pandas: Working with Data Frame, Importing fromExcel or .csv files,

	Powerful filters and indexes. Numpy: Selecting data with loc and iloc, Using NumPy for speed, Trade-offs between arrays and lists, Array functions.
Week 8	Data cleansing and normalization: Libraries for data visualization, Types of charts/graphs and how to build them. (Assignment-2)
Week 9	Machine learning: Introduction, Definitions, Supervised,
Week 10	unsupervised, python libraries for machine learning
Week 11	Sci-kit learn
Week 12	Regression: Linear regression,
Week 13	Logistic regression,
Week 14	Overfitting and regularization.

Essential/recommended readings

- Pilgrim, M. (2004). Dive Into Python. Apress. Ch. 1,2,4
- S Raschka, Python Machine Learning, □ V Mirjalili (2020), Ch 3
- Mitchell, T. M. (1997). Machine Learning. New York: McGraw-Hill.

Suggestive Readings

- Liu, Y. (2019). Python machine learning by example: Implement machine learning algorithms and techniques to build intelligent systems (Second edition.). Packt Publishing.
- Boschetti, A. (2016). Regression Analysis with Python (1st ed.). Packt Publishing. Retrieved from https://www.perlego.com/book/4457/regressionanalysis-with-python- pdf (Original work published 2016)
- Sivanandam, S.N., & Deepa, S.N. (2011). Principles of soft computing.