

COURSE TITLE: Database Management Systems

A Core Course (UG2) for CSE/ECE

Course Level: Core

L-T-P-C: 3 - 1 - 0 - 4

Pre-requisite: No prerequisite as such. Knowledge on Operating Systems may be helpful. (refer to Section: 5)

1. OUTLINE:

A Database Management System (DBMS) is a software system which is designed to effectively store, organize, update, insert and query bulk of data. With the inception of the idea of relational data models since 1970, the DBMS industry has seen growth of approximately \$100 billion a year and incrementally increases by about 25% per year. Due to the advent of emerging internet applications and online portals, they heavily rely upon DBMS design and implementation, thus the database market is expected to grow even faster to ensure data integrity, security and ease of updation.

2. OBJECTIVES:

The concepts related to database, database techniques, SQL queries and database operations are introduced in this subject. This creates strong foundation for application data design.

3. COURSE OUTLINE (TOPICS): The following list of topics is very tentative.

Based on available time slots, some topics may be dropped or added or reordered. No. of hours may vary as per the requirement of any particular topic(s).

Unit - I (No of hours: 7)

INTRODUCTION: Data base system concepts and its architecture, Data models schema and instances, Data independence and data base language and interface, Data definition languages, DML. Overall data base structure. DATA MODELING USING ER MODEL: ER model concept, notation for ER diagrams mapping constraints, Keys, Concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model.

Unit - II (No of hours: 7)

RELATIONAL DATA MODEL AND LANGUAGE: Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions, triggers, foreign key relational algebra, relational calculus, domain and tuple calculus, SQL data definition queries and updates in SQL.

Unit - III (No of hours: 7)

DATABASE DESIGN: Functional dependencies, normal forms, 1NF, 2NF, 3NF and BCNF, multi-valued dependencies fourth normal forms, join dependencies and fifth normal forms. Inclusion dependencies, loss less join decompositions, normalization using FD, MVD and JDs, alternatives approaches to database design.

Unit - IV (No of hours: 7)

STORAGE AND FILE ORGANIZATION: File Organization, Indexing and Hashing Overview of file organization techniques, Indexing and Hashing- Basic concepts, Static Hashing, Dynamic Hashing, Ordered indices, Multi-level indexes, B-Tree index files, B+- Tree index files, Buffer management. Introduction to Scalable Databases.

Unit - V (No of hours: 7)

TRANSACTION PROCESSING CONCEPTS: Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recovery from transaction failures, deadlock handling. CONCURRENCY CONTROL TECHNIQUES: Locking Techniques for concurrency control, time stamping protocols for concurrency control.

TEXT BOOKS

* Silberschatz, H. Korth & S. Sudarshan, Database System Concepts, TMH, 5th Edition, 2010.

* R. Elmasri & S.B. Navathe, Fundamentals of Database Systems, Pearson Education, 6th edition, 2010.

REFERENCES BOOKS

* C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

* J. D. Ullman, "Principles of Database Systems", 2nd Ed., Galgotia Publications, 1999.

* R. Ramakrishnan & J. Gehrke, Database Management Systems, 3rd edition, TMH, 2007.

5. PRE-REQUISITES:

No prerequisite as such. Knowledge on Operating Systems may be helpful. Programming knowledge on web app development may be helpful in project element.

6. COURSE WORK:

Course grades will be based on the following weightage pattern. This is purely indicative and necessary modification will be made by the faculty depending on the intensity of the different work assigned for various tasks.

a) EXAMINATIONS: 60%

Mid Semester - 1 Exam: 10%

Mid Semester - 2 Exam: 10%

End Semester Exam: 40%

b) Assignments: 10%

c) Project WORK: 30%

Project Ideas: 1. University Faculty Academic Load Management System (MS)

2. Rental MS
3. Library MS
4. Hostel MS
5. Trip Planner
6. Healthcare MS
7. Timetable MS
8. College ERP
9. Canteen MS
10. Inventory MS
11. Multiplex MS
12. Online Business Management System (similar to Amazon/Flipkart)
13. Transportation MS
14. Sports MS
15. Event MS
16. Movie Review System/MS (similar to IMDB)
17. Online Music Store (similar to Wynn/Saavn)
18. Agriculture MS

and any other innovative ideas. Some component of ORACLE/MYSQL/NoSQL (MongoDB, DynamoDB, Cassandra) is must and can use other tools like Django, swing-gui, css, html, android app, bootstrap, php, applet, postgresql etc.

Additional Elements: i) Scribe Writing

Regulations: As instructed in the class scribe notes by 5 students assigned for every week. The scribes would be selected by the instructor.

The idea is to encourage the expression skills, technical writing skills and team work amongst the students. Instructions for this are outlined as follows:

1. Students need to pen down the class notes, their intuitions & analysis, information from various web sources on the requisite topics and very nicely outline the ideas.
2. Students can always put out any specific idea that they want to highlight and take-home messages.
3. All 5 assigned scribes do that in class independently and share notes amongst them at the end of the day. The resultant class notes would be a compiled version of all the assigned scribes and free of any possible redundancies.
4. They compile them for all 3 days (M,W,F) in a week and write on the document the scribe names and roll nos. on top, date and day for the talk, list of topics covered in class followed by scribe notes on each topic in detail.
5. They submit the scribe for each week on weekend to the instructor. Deadline would be announced in class.

Note: Strict vigilance on the sources you refer in the scribe. Give proper references against the image sources plus statistics students provide. For rest, textual material they need to paraphrase entirely and put it in their own words.

ii) Guest Lecture on NoSQL Databases-MongoDB

7. INDUSTRY IMPACT:

The course could have the following impact on the industry:

- (a) Data Analytics
- (b) Retail/Inventory Industry/Business ERP Models/Customer Relationship Management (CRM)
- (c) In memory database management
- (d) Banking Services

For more: Forecast of DBMS market:

<https://www.marketresearchfuture.com/reports/database-management-system-market-1972>

8. LIST OF COMPANIES WORKING ON RELATED TOPICS:

The following companies are working on the following topics of interest:

- * Oracle
- * Microsoft SQL Server
- * MySQL
- * PostgreSQL
- * IBM DB2
- * Informix
- * Sybase SAP ASE
- * MongoDB
- * TCS BaNCS
- * Amazon's Simple DB

For More refer: <https://www.softwaretestinghelp.com/database-management-software/>

9. RESOURCES:

- a) Introduction to Database Management systems (COSC 341)
Indiana University of Pennsylvania
Link: <https://www.iup.edu/compsci/undergrad/students/courses/cosc-341-introduction-to-database-management-systems/>

- b) Database Management System (CS 15721)
By Prof. Anastassia Ailamaki, CMU
Link: <http://www.cs.cmu.edu/afs/cs/academic/class/15721-f01/www/index.html>

- c) https://onlinecourses.nptel.ac.in/noc18_cs15/preview

10. COURSE ETHICS:

Please note down the following activities leading to a fair academic honesty:

- a) Project work to be done in a group of 5-6.
- b) Students are encouraged to work together to do project problems. Groups who work well together in class should consider working together to do project work. What is important is a student's eventual understanding of project problems, and not how that is achieved. [Following the Prof. Amit Chakrabarti's detailed grading policy: <https://ssl.cs.dartmouth.edu/~ac/Teach/CS49-Winter17/admindetails.html#grading> (Working Together and Honor Policy)]
- c) Clearly cite all the references in code materials while report writing. No external paid services to be used.

COURSE Plan submitted by

Dr. Prerana Mukherjee
Assistant Professor
Indian Institute of Information Technology Sri City
Andhra Pradesh - 517646, India.
Ph: +91-9100129741 (Official)
e-mail: prerana.m@iiits.in