NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPALLI - 620015

Advanced Database Management Systems **3 Credits theory – Core course**
M.Tech./CS **Session: II semester – Jan. 2017 – May 2017**

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Pre-requisites:

- Knowledge of data structures, algorithms, principles of programming languages and computer organization is required.

- A first level exposure to database systems will be assumed; this includes the following: need for database systems, types of data in computer based systems, organization of an RDBMS, types of users and their roles, advantages of a database, features and facilities of data definition and manipulation languages, relational algebra and calculus, SQL programming and embedded SQL, client-server system architecture and associated technologies and business logic.

Course overview:

For organizing moderately large volumes of structured data (operational data arising for example, in airlines reservations, banking applications, human resource management) the relational database management technology (RDBMS) is still the preferred choice in the industry. This underscores the importance of this course when the Big Data revolution is the current buzzword. The course begins with a review of schema design for relational systems often conveniently ignored at a first level. The design aspects are covered only from a formal perspective so that the pitfalls in schema design can be avoided. RDBMS architecture is then reviewed at a high level. In doing so a quick overview of core SQL details is done through a series of graded examples. The course then moves to the foundations of query processing – this begins with relational algebra. Then algorithmic considerations to process selection, projection and join are outlined and the use of a various strategies and heuristics are examined. This is followed by the foundations in transaction processing. The course then continues with concurrency control techniques beginning with correctness of concurrent execution. Finally recovery techniques are covered and some recent trends in RDBMS are outlined.

The following texts will be used.

1. R.Ramakrishnan and J.Gehrke, Database Management Systems, McGraw-Hill, 2003.
2. A.Silberschatz, H.F.Korth and S.Sudarshan, Database System Concepts, McGraw-Hill, 2006.

Course objectives and expected outcomes:

- After the course about 60% of the students should be able to participate in database design. About 80% will be able to write SQL scripts independently.
- About 60% of the students will be able to pick up associated technologies such as Java or Python, ODBC related packages, PHP.
- Another objective is to quickly introduce XML technology for integration with RDBMS.
- More than 85% of the students will be ready to absorb, at a high level, any new market innovation related to transaction processing and database recovery.

Teaching-learning activities:

A. Lectures on the following topics will be the chief method of content delivery. Starting from January 2017, every week will normally have three lectures. A total of 40 lectures each lasting for 45 minutes is planned as per the announced time table. Classes lost due to holidays will suitably compensated by prior announcements in consultation with the students. These compensation classes may be scheduled during off-times if necessary during Saturdays.

During the process of lectures students must refer to the suggested books (available in the library) and other references and handouts. The following topics will be dealt with in some details.

- Preliminaries in defining a relational system. functional dependency and discovering them systematically, schema design via 3NF, BCNF, MVDs, hard problems in the design, a peek into modern approach to design.

- Need for processing single queries optimally, SQL and equivalent relational algebra expressions, processing selection – file scan and other assumptions, processing projection, processing aggregate operations, processing join – use of hashing, equivalent transformations, heuristic query optimizations.

- Characteristics of transactions, enhanced SQL provisions, modeling a transaction, need for concurrent executions, correctness of interleaved executions, cascadelessness and recoverability, locking basics, 2PL and its correctness, 2PL variants, performance of 2PL, notion of timestamps, basic timestamp ordering, optimistic concurrency control, dynamic databases.

- System failures and software failures, recoverability techniques – UNDO, REDO protocol, some recent trends in database related technology.

B. For every one lecture an average student is expected to spend two hours. The supplementary readings will help in the understanding of the subject. During the first two weeks non-CS students are required to refer to suggested books to get the prerequisites.

Tests and assignments

1. Continuous assessment: (a) Two tests for 1.5 hours each for 20 marks.

   (b) One quiz for 10 marks for 1 hour duration

   (c) Two take-home assignments totaling for 10 marks

2. Final examination: For a duration of 3 hours and for 40 marks

[the exact dates, time and venue will be announced during the first week]

Course feedback from students

Students are encouraged to make comments as well as criticisms. Constructive suggestions are welcome; students are also welcome to use the email and the office mailbox to give informal feedback to help the teaching-learning process.

It is planned to collect two feedbacks in a specified format – one during the progress of the course and one after the final examination.

Course policy – academic honesty, attendance, copying

Maintaining at least 75% attendance is recommended – institute attendance rules will apply. Copying in assignments or tests will be viewed seriously. Students are expected to display a high degree of professionalism. Any unethical practice will attract punishment. Collaborating in assignments should be marked in the first page.

2nd Jan. 2017

K. V. Iyer (Instructor)
Professor

3/1/17

3/1/2017

HOD/CSED