

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS208	Principles of Database Design	2-1-0-3	2016
Pre-requisite: CS205 Data structures			
Course Objectives			
<ul style="list-style-type: none"> To impart the basic understanding of the theory and applications of database management systems. To give basic level understanding of internals of database systems. To expose to some of the recent trends in databases. 			
Syllabus:			
Types of data, database and DBMS, Languages and users. Software Architecture, E-R and Extended E-R Modelling, Relational Model – concepts and languages, relational algebra and tuple relational calculus, SQL, views, assertions and triggers, relational db design, FDs and normal forms, Secondary storage organization, indexing and hashing, query optimization, concurrent transaction processing and recovery principles, recent topics.			
Expected outcome.			
Students will be able to:			
<ol style="list-style-type: none"> define, explain and illustrate the fundamental concepts of databases. construct an Entity-Relationship (E-R) model from specifications and to perform the transformation of the conceptual model into corresponding logical data structures. model and design a relational database following the design principles. develop queries for relational database in the context of practical applications define, explain and illustrate fundamental principles of data organization, query optimization and concurrent transaction processing. appreciate the latest trends in databases. 			
Text Books:			
<ol style="list-style-type: none"> Elmasri R. and S. Navathe, <i>Database Systems: Models, Languages, Design and Application Programming</i>, Pearson Education, 2013. Sliberschatz A., H. F. Korth and S. Sudarshan, <i>Database System Concepts</i>, 6/e, McGraw Hill, 2011. 			
References:			
<ol style="list-style-type: none"> Powers S., <i>Practical RDF</i>, O'Reilly Media, 2003. Plunkett T., B. Macdonald, <i>et al.</i>, <i>Oracle Big Data Hand Book</i>, Oracle Press, 2013. 			
Course Plan			
Module	Contents	Hours (42)	Sem. Exam Marks
I	Introduction: Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Database architectures and classification. (Reading: Elmasri Navathe, Ch. 1 and 2. Additional Reading: Silbershatz, Korth, Ch. 1) Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-	06	15%

	Relationship Diagram, Weak Entity Sets, Relationships of degree greater than 2 (Reading: Elmasri Navathe, Ch. 7.1-7.8)		
II	Relational Model: Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema (Reading: Elmasri Navathe, Ch. 3 and 8.1, Additional Reading: Silbershatz, Korth, Ch. 2.1-2.4) Database Languages: Concept of DDL and DML relational algebra (Reading: Silbershatz, Korth, Ch 2.5-2.6 and 6.1-6.2, Elmasri Navathe, Ch. 6.1-6.5)	06	15%
FIRST INTERNAL EXAM			
III	Structured Query Language (SQL): Basic SQL Structure, examples, Set operations, Aggregate Functions, nested sub-queries (Reading: Elmasri Navathe, Ch. 4 and 5.1) Views, assertions and triggers (Reading: Elmasri Navathe, Ch. 5.2-5.3, Optional reading: Silbershatz, Korth Ch. 5.3).	07	15%
IV	Relational Database Design: Different anomalies in designing a database, normalization, functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover (proofs not required). Normalization using functional dependencies, 1NF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions (Reading: Elmasri and Navathe, Ch. 14.1-14.5, 15.1-15.2. Additional Reading: Silbershatz, Korth Ch. 8.1-8.5)	07	15%
SECOND INTERNAL EXAM			
V	Physical Data Organization: index structures, primary, secondary and clustering indices, Single level and Multi-level indexing, B+-Trees (basic structure only, algorithms not needed), (Reading Elmasri and Navathe, Ch. 17.1-17.4) Query Optimization: heuristics-based query optimization, (Reading Elmasri and Navathe, Ch. 18.1, 18.7)	07	20%
VI	Transaction Processing Concepts: overview of concurrency control and recovery acid properties, serial and concurrent schedules, conflict serializability. Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing, (Reading Elmasri and Navathe, Ch. 20.1-20.5 (except 20.5.4-20.5.5) , Silbershatz, Korth Ch. 15.1 (except 15.1.4-15.1.5), Ch. 16.1 – 16.5) Recent topics (preliminary ideas only): Semantic Web and RDF(Reading: Powers Ch.1, 2), GIS, biological databases (Reading: Elmasri and Navathe Ch. 23.3-23.4) Big Data (Reading: Plunkett and Macdonald, Ch. 1, 2)	09	20%
END SEMESTER EXAM			