Adi Shankara
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Approved by AICTE & Affiliated to APJ Abdul Kalam Technological University
Vidya Bharathi Nagar , Mattoor, Kalady, Ernakulam District, Kerala State Pin: 683574

CRITERION 6 -

GOVERNANCE, LEADERSHIP AND MANAGEMENT

6.5 Internal Quality Assurance System

CDM
Reviewed Version

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CDM

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Vidya Bharathi Nagar , Mattoor, Kalady, Ernakulam, Kerala 683574

COURSE DELIVERY MANUAL

(B.Tech Programme)

2019 | S4 | CST 204 | 2 | 2

Name of Course with code	: CST204 Database Management Systems
Offering Department	: CSE & AI
Semester & Programme (Branch)	: S4 CSE & AI
Course Instructor , Department	: Prof. Sumesh Raman, AI
	: Prof. Prabhu M, CSE
Name & Designation of Stream Coordinator	: Prof. Simi MS : Prof. Raghi R Menon
Academic Year	: 2022-23
Type of the Course Content*	: Theoretical
Course project linked (Y/N)	:Y

{* 1.Introductory 2.Theoretical 3.Problematic 4.Analytical 5.Programming 6.Simulation 7.Designing 8.Practical/implementation.}

1. Course Overview:

This course provides a clear understanding of fundamental principles of Database Management Systems (DBMS) with special focus on relational databases to the learners. The topics covered in this course are basic concepts of DBMS, Entity Relationship (ER) model, Relational Database principles, Relational Algebra, Structured Query Language (SQL), Physical Data Organization, Normalization and Transaction Processing Concepts. The course also gives a glimpse of the alternative data management model, NoSQL. This course helps the learners to manage data efficiently by identifying suitable structures to maintain data assets of organizations and to develop applications that utilize database technologies

2. Course Pre-Requisites:

Topics covered under the course Data Structures (CST 201), Exposure to a High Level Language like Java/python.

3. Course Syllabus:

Course: CST204 Database Management Systems

Module 1: Introduction & Entity Relationship (ER) Model Concept & Overview of Database Management Systems (DBMS) - Characteristics of Database system, Database Users, structured, semi-structured and unstructured data. Data Models and Schema - Three Schema architecture. Database Languages, Database architectures and classification.
ER model - Basic concepts, entity set & attributes, notations, Relationships and constraints, cardinality, participation, notations, weak entities, relationships of degree 3.

Module 2: Relational Model Structure of Relational Databases - Integrity Constraints, Synthesizing ER diagram to relational schema -Introduction to Relational Algebra - select, project, Cartesian product operations, join - Equi-join, natural join. Query examples, introduction to Structured Query Language (SQL), Data Definition Language (DDL), Table definitions and operations – CREATE, DROP, ALTER, INSERT,DELETE, UPDATE.

Module3: SQL DML (Data Manipulation Language), Physical Data Organization SQL DML (Data Manipulation Language) - SQL queries on single and multiple tables, Nested queries (correlated and non-correlated), Aggregation and grouping, Views, Assertions, Triggers, SQL data types. Physical Data Organization - Review of terms: Physical and logical records, blocking factor, pinned and unpinned organization. Heap Files, Indexing, Singe level indices, numerical examples, Multi-level-indices, numerical Examples, B-Trees & B+-Trees (structure only, algorithms not required), Extendible Hashing, Indexing on multiple keys – grid files.

Module 4: Normalization 3 Different anomalies in designing a database, The idea of normalization, Functional dependency, Armstrong's Axioms (proofs not required), Closures and their computation, Equivalence of Functional Dependencies (FD), Minimal Cover (proofs not required). First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Boyce Codd Normal Form (BCNF), Lossless join and dependency preserving decomposition, Algorithms for checking Lossless Join (LJ) and Dependency Preserving (DP) properties.

Module 5: Transactions, Concurrency and Recovery, Recent Topics Transaction Processing Concepts - overview of concurrency control, Transaction Model, Significance of concurrency Control & Recovery, Transaction States, System Log, Desirable Properties of transactions. Serial schedules, Concurrent and Serializable Schedules, Conflict Equivalence and conflict serializability, Recoverable and cascade-less schedules, Locking, Two-phase locking and its variations. Log-based recovery, Deferred database modification, check-pointing. Introduction to NoSQL Databases, Main characteristics of Key-value DB (Examples from:Redis), Document DB (examples from: MongoDB) Main characteristics of Column - Family DB (examples from: Cassandra) and Graph DB(examples from : ArangoDB)

Text Books

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.

2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.

Reference Books

1. Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015
2. NoSQL Data Models: Trends and Challenges (Computer Engineering: Databases and Big Data), Wiley, 2018

Web Resources

1. https://www.w3resource.com/redis/
2. https://www.w3schools.in/category/mongodb/
3. https://www.tutorialspoint.com/cassandra/cassandra_introduction.htm
4. https://www.tutorialspoint.com/arangodb/index.htm

4. Course Objectives:

a. To impart the basic understanding of the theory and applications of Database Management systems.
b. To give basic level understanding of internals of database systems.
c. To expose some of the recent trends in database

5. Course Outcomes:

After the completion of this course, students shall be able to:

CO No.	Course Outcome	Knowledge Level
CO1	Summarize and exemplify fundamental nature and characteristics of database systems	Understand(K2)
CO2	Model real word scenarios given as informal descriptions, using Entity Relationship diagrams.	Apply(K3)
CO3	Model and design solutions for efficiently representing and querying data using relational model	Analyze(K4)
CO4	Demonstrate the features of indexing and hashing in database applications	Apply(K3)
CO5	Discuss and compare the aspects of Concurrency Control Recovery and Normalization in Database systems	Apply(K3)
CO6	Explain various types of NoSQL databases	Understand(K2)

6.CO-PO and CO-PSO mapping :

CO/PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2		2			2				2	2	2
2	3	2	3	2				2				2	3	2
3	3	2	2	2				2				2	3	2
4	3	3	2		2			2		2		2	3	3
5	3	3	1					2		2		1	3	3

1-Slightly, 2-Moderately, 3-Strongly

7. Gaps in the syllabus:

Sl. No	Description	Proposed Actions	PO affected
1	Query Processing	Assignment/Seminar	1,2,3,4,6,8

8. Content beyond Syllabus: To meet Research/ Industry/ Professional Requirements:

Sl. No	Description	Relevant COs, Pos
1	Different data models supported in IBM DB2	1,2,3,4,,9

9. Schedule for implementation of the course:

Class	Topics and Subtopics	Course Outcome	Learning Activities	Reference	Pg.No:
MODULE-1 **Introduction & Entity Relationship (ER) Model** (8 hours)					
1.1	Concept & Overview of DBMS, Characteristics of DB system, Database Users.	CO1	1,2,C	T1	4-12
1.2	Structured, semi-structured and unstructured data. Data Models and Schema	CO1	1,2,C	T2,T1	8, 22-24
1.3	Three-Schema-architecture. Database Languages	CO1	1,2,C	T1	25-28
1.4	Database architectures and classification	CO1	1,2,C	T1	29-32

3.2	Nested queries (correlated and non-correlated)	CO3	1,2,C	T1	190-194
3.3	Aggregation and grouping	CO3	1,2,C	T1	196-198
3.4	Views, assertions (with examples)	CO3	1,2,B,C	T1	205-208
3.5	Triggers (with examples), SQL data types	CO3	1,2,C	T1	293 - 295
3.6	Review of terms: physical and logical records, blocking factor, pinned and unpinned organization. Heap files, Indexing	CO4	1,2,C	T1	305-310
3.7	Singe level indices, numerical examples	CO4	1,2,C	T1	329-331
3.8	Multi-level-indices, numerical examples	CO4	1,2,C	T1	332-337
3.9	B-Trees and B+Trees (structure only, algorithms not required)	CO4	1,2,A,C	T1	338-341
3.10	Extendible Hashing	CO4	1,2,C,D	T1	321-324
3.11	Indexing on multiple keys – grid files	CO4	1,2,C	T1	354-356
	Module 4: **Normalization** (8 hours)				
4.1	Different anomalies in designing a database, The idea of normalization	CO5	1,2,C	T1	241-249
4.2	Functional dependency, Armstrong's Axioms (proofs not required)	CO5	1,2,C	T1	249-251
4.3	Closures and their computation, Equivalence of FDs, minimal Cover (proofs not required).	CO5	1,2,C,D	T1	251-254

4.4	1NF, 2NF	CO5	1,2,C	T1	258-260
4.5	3NF, BCNF	CO5	1,2,C	T1	262-265
4.6	Lossless join and dependency preserving decomposition	CO5	1,2,C	T1	271-273
4.7	Algorithms for checking Lossless Join and Dependency preserving properties (Lecture 1)	CO5	1,2,C	T1	273-277
4.8	Algorithms for checking Lossless Join and Dependency preserving properties (Lecture 2)	CO5	1,2,A,C	T1	273-277
Module 5: **Transactions, Concurrency and Recovery, Recent Topics(14)**					
5.1	Transaction Processing Concepts: Transaction Model	CO5	1,2,C	T1	407 - 409
5.2	Overview of concurrency control, Significance of concurrency Control & Recovery	CO5	1,2,C	T1	410 - 413
5.3	Transaction States, System Log	CO5	1,2,A,C	T1	413 - 415
5.4	Desirable Properties of transactions, Serial schedules	CO5	1,2,C	T1	416-417
5.5	Concurrent and Serializable Schedules	CO5	1,2,C	T1	419 - 421
5.6	Conflict equivalence and conflict serializability	CO5	1,2,C	T1	422 - 426
5.7	Recoverable and cascade-less schedules	CO5	1,2,C	T1	418-419
5.8	Locking, Two-phase locking, strict 2PL.	CO5	1,2,,C	T2	636 - 644
5.9	Log-based recovery	CO5	1,2,,C	T1	450-454

5.10	Deferred database modification (serial schedule), example	CO5	1,2,C	T2	454-456
5.11	Deferred database modification (concurrent schedule) example, check-pointing	CO5	1,2,C	T2	457-461
5.12	Introduction to NoSQL Databases	CO6	1,2,C	R1	26-34
5.13	Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB) [detailed study not expected]	CO6	1,2,C	R1	95-115
5.14	Main characteristics of Column-Family DB (examples from: Cassandra) and Graph DB (examples from : ArangoDB) [detailed study not expected]	CO6	1,2,C	R1	257-275

Learning Activities:

Lecture:

I. Black Board Teaching
II. Smart Class Teaching

Tutorials:

A. Assignment
B. Quiz
C. Presentation
D. Group Discussion
E. Think Pair Share etc.

10. Assignment Activity: (Sample Questions should be given)

COs	*Assignment Question	**Assessment method	POs mapped
CO 1	Three-Schema-architecture. Database Languages	Assignment	PO1,PO2,PO3,PO8
CO 2	ER diagram – exercises	Tutorial	PO1, PO 2, PO3, PO8
CO3	Relational Algebra Query	Assignment	PO1, PO 2, PO3,

	Examples		PO6,PO8
CO3	SQL -Query example, Nested query, Join	Assignment	PO1, PO 2, PO3, PO8
CO 3	Views & Assertions	Seminar/Assignment	PO1, PO 2, PO3, PO8
CO3	SQL- Trigger	Assignment	
CO 4	B-Trees and B+Trees	Test Paper	PO1, PO 2, PO3, PO8
CO 4	Problems on Indexing/Multi level indexing	Assignment	PO1, PO 2, PO3, PO8
CO 4	Extensible Hashing	Assignment	PO1, PO 2, PO3, PO8
CO5	Normalization	Seminar/Assignment	PO1, PO 2, PO3, PO8
CO 5	Transaction States, System Log	Assignment	PO1, PO3, PO8
CO 6	Main characteristics of MongoDB	Classwork/ Tutorial	PO1,PO3,PO8

Name and Signature of the Course Instructor: Roslin R Mundur

Sumesh Raman **Date:**

Comments by the Stream Coordinator:
checklist & CO assessment value to be included
COPO justification to be added. Roslin R Mundur

Name and Signature of the Stream Coordinator: **Date:**

Academic Head.

Name and Signature of the IQAC Coordinator: **Date:**

Name and Signature of the HOD: **Date:**

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