

COURSE FILE
For
Information Management Systems (ECSE211L)

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Course Type : Core

Semester and Year: III Semester / II Year

L-T-P : 3-0-2

Credits : 4

Department : Computer Science Engineering

Course Level : UG

School of Engineering and Applied Sciences
Department of Computer Science Engineering



Bennett University
Greater Noida, Uttar Pradesh

1. Detailed Syllabus of the Course

Course Type:	Core
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L	T	P	Credits
3	0	2	4

Pre-requisites: NA

Course Learning Outcomes:

CLO1: Show the understanding of the fundamentals relational database systems.

CLO2: Construct databases using DBMS products such as MySQL/Oracle/My SQL Server.

CLO3: Design database systems and understand new developments and trends in databases.

Module 1 (Contact hours: 12)

Introduction and applications of DBMS, Purpose of database, Data independence, Database system architecture- Levels, Mappings, Database users and DBA; Entity Relational Model: Definition, Basic concepts, Attributes, Relationships, Cardinality, Extended features, Aggregation; Relational Model: Structure of relational databases, Domains, Relations; Relational algebra: Fundamental operators and syntax, Relational algebra queries, Selection operation, Sorting, Join, Subquery, Tuple relational calculus.

Module 2 (Contact hours: 12)

Functional Dependency: Definition, Trivial and non-trivial FD, Closure of FD set, Closure of attributes, Irreducible set of FD; Normalization: 1NF, 2NF, 3NF. Decomposition using FD: dependency preservation, BCNF, Multivalued dependency, 4NF, and 5NF; Overview and measures of query cost, Evaluation of expressions, Transformation of relational expressions.

Module 3 (Contact hours: 9)

Transaction: Concepts, Properties of transactions, Serializability of transactions, Testing for serializability. System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems; Locking mechanism, Solution to concurrency related problems, Deadlock, Two-phase locking protocol, Isolation, Intent locking; Introduction, Discretionary access control, Mandatory Access Control, Data Encryption.

Module 4 (Contact hours: 9)

Introduction to Distributed Database Systems (DDS), pro and cons of DDS, Transactions, Commit, and Transparency in DDS. Data warehousing; Introduction to NoSQL database systems, Column stores, RDF stores, MongoDB; Hadoop MapReduce Algorithms for expensive queries over big data.

Suggested Textbooks:

- 1) *Elmasri, Ramez and Shamkant B. Navathe, Fundamentals of database systems, (7th Edition) Pearson, 2015. ISBN- 978-0133970777.*
- 2) *Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill, 2010, ISBN:0-07-352332-1*
- 3) *Jeffrey A. Hoffer, Heikki Topi, V Ramesh – MODERN DATABASE MANAGEMENT, 10 Edition, PEARSON, 2012*

References:

- 1) Date C.J, "An Introduction to Database", 8th Edition, 2003, Addison-Wesley Pub Co, ISBN: 9780321197849
- 2) *Ramakrishnan, Raghu and Johannes Gehrke, Database management systems (3rd Edition), McGraw Hill, 2000. ISBN- 978-0072465358.*
- 3) *Supplementary Resource: -
<http://ovid.cs.depaul.edu/Classes/CSC355S14/CSC355links.htm>*

MOOC Reference:

1. Database Systems Concepts & Design by Georgia Tech
<https://www.udacity.com/course/database-systems-concepts-design--ud150>
2. Structured Database Environments by from Southern New Hampshire University
<https://www.edx.org/course/structured-database-environments-with-sql>

2. Evaluation policy of the course

Components of Course Evaluation	Percentage
Mid Term Examination	20
Quiz	15
Continuous Lab Evaluation	10
Lab Exam	10
Class participation	10
End Term Examination	35

3. Lecture wise Plan

Lecture Wise Plan

Lecture No.	Content Planned
1	Introduction of Database Management System, Background, Database System vs File System
2	Database concepts, Database applications, Evolution of database
3	Data abstraction, Schema and instances, Data independence, Data models, Database languages and interfaces,
4	Database system architecture, components, database users and DBA
5	Data modelling using Entity Relationship Model: ER concepts,
6	Mapping Constraints, Keys, Notations for E-R diagram, Extended E-R Model
7	Reduction of an E-R Diagram to Tables, Relationship of higher degree
8	Domains, Relations
9	Relational algebra – fundamental operators and syntax, relational algebra queries,
	Quiz 1
10	Tuple relational calculus.
11	Introduction of SQL, Advantages of SQL, SQL data types and literals, types of SQL Commands
12	SQL operations and their precedence, Tables and views, Indexes, Queries in SQL, Subqueries in SQL, Complex Queries, Joins, Triggers
13	Pitfalls in Relational Database Design, Functional dependencies, Inclusion dependencies
14	Data redundancy and update anomalies, Decomposition definition, trivial and non-trivial FD,
15	Closure of FD set, closure of attributes, Irreducible set of FD
16	Normalization – 1NF, 2NF, 3NF
17	Normalization – BCNF, multivalued dependencies and join dependencies
18	4NF, and 5NF
	Syllabus up to Mid-Term Exam
19	Overview and measures of query cost, Evaluation of expressions, Transformation of relational expressions,

20	Estimating statistics of expression results, Evaluation plans, Materialized views
21	Transaction Processing Concept: ACID Properties
22	Transaction State, Concurrency
23	Schedule, Serializability, Testing of Serializability
24	System recovery, Two- Phase Commit protocol,
25	Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems
26	Concurrency Control Techniques: Locking techniques
27	Locks, locking protocols, two phase locking protocol, graph-based protocol
28	Solution to concurrency related problems, Deadlock timestamp protocol for concurrency control
29	Two-phase locking protocol, Isolation, Intent locking
	Quiz 2
30	Validation-based protocol, multiple granularity, multi-version schemes, recovery and concurrent transaction
31	Introduction, Discretionary access control, Mandatory Access Control
32	Data Encryption
33	Introduction to Distributed Database Systems (DDS), Pros and cons of DDS
34	Transactions, commit, transparency in DDS
35	Data warehousing
36	Big data technologies, including big data storage, big data processing and big data analytics using cloud database
37	Big SQL query processing on clouds
38	Introduction to NoSQL database systems, Column stores, RDF stores
39	Hbase, Hadoop MapReduce Algorithms for expensive queries over big data.
	Expert Lecture
40	Case studies: Building the information management systems of various real-life examples
41	Case studies: Building the information management systems of various real-life examples, issues and challenges and opportunity

42	SAP, Design and analysis of Stock exchange, student record keeping, time table management, news and media posts, social media trends based IMS
	End-Term-Exam

Lab Plan:

Lab No	Content
1	Introductory session about the database tools and importance of designing the backend
2	SQL Concepts: - Basics of SQL, DDL, DML, DCL
3	SQL Concepts: - Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator
4	Working with Non-procedural query language unlike relational algebra as a Tuple Relational Calculus
5	Entity-Relationship model: - Basic concepts, Design process
6	Constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema.
Lab Exam 1	
7	Subquery in SQL
8	Views
9	PL SQL: Stored Procedure
10	PL SQL: Triggers
11	Working and connecting the frontend to a SQL database backend server
12	Any enterprise management information system design and analysis demonstration
Lab Exam 2	
13	NOSQL: MONGO DB
14	Working on Firebase Realtime Database is a cloud-hosted NoSQL database

Lab Software:

- MySQL, Oracle, MongoDB, CodeZinger .

Suggest at least 3 innovations how this will enhance learning outcome of the course.

- a. Weekly Quizzes.
- b. Discussion on LMS
- c. Doubt clearing classes on MS teams.
- d. Doubt clearing weekly forum on LMS.
- e. Recording of lecture session for quick revision.

Tentative date/speaker for industry talk. (Mentioned in Lecture plan)

List tools (teaching and lab) that can be used in course.

- a. Mentimeter
- b. Codezinger
- c. Kahoots
- d. Acadly

1. You Tube Playlist

<https://youtube.com/playlist?list=PLwo3x88zUZ8szHSrzWUQJJgHAWMsORSOd>