BMS\_MCA\_2023 \_Scheme\_and\_Syllabus.pdf

• Database Management Systems  
 o Introduction to DBMS  
 o Database System Architecture  
 o Entity-Relationship Model  
 o Relational Model  
 o SQL Queries  
 o Database Design  
 o Transaction Management  
 o Database Programming  
 o Stored Procedures and Functions  
 o Triggers  
 o Views  
 o Normalization  
 o Concurrency Control  
 o Recovery Techniques  
• Advanced Database Management Systems  
 o DBMS Architecture  
 o Relational Database Design  
 o Advanced SQL and PL/SQL  
 o Views and Assertions  
 o Materialized Views  
 o Summary Management  
 o Functions and Procedures  
 o Packages  
 o Synonyms  
 o Sequences  
 o Query Processing and Evaluation  
 o Transaction Management and Recovery  
 o Database Security and Authorization  
 o Distributed Database  
 o Object-Oriented Database  
 o XML and Databases  
 o Multimedia Database  
 o Deductive Databases  
 o GIS and Spatial Database  
 o Knowledge Database  
 o Information Visualization  
 o Gnome Database

BMS\_Syllabus.pdf

• Database Management Systems  
 o Introduction to Databases  
  Introduction  
  An Example  
  Characteristics of Database approach  
  Advantages of using DBMS approach  
  When not to use a DBMS  
 o Database System Concepts and Architecture  
  Data models  
  Schemas and instances  
  Three schema architecture  
 o SQL  
  SQL Data Definition and Data Types  
  Specifying basic constraints in SQL  
  Schema Change Statement in SQL  
  Basic retrieval queries in SQL  
  Insert, Delete and Update statements in SQL  
  Additional features of SQL  
  More complex SQL Queries  
  Views (Virtual Tables) in SQL  
  Triggers and Stored Procedures  
• Data Modelling  
 o Entity-Relationship (ER) model  
  Using High-Level conceptual Data Models for Database Design  
  A sample Database Application  
  Entity types, Entity Sets, Attributes and Keys  
  Relationship Types, Relationship Sets, Roles and Structural Constraints  
  Weak Entity types  
  Refining the ER Design  
  ER Diagrams  
  Relationship Types of Degree Higher than two  
  Relational Database Design using ER-to-Relational Mapping  
 o Relational Algebra  
  Unary Relational Operations  
  SELECT and PROJECT  
  Relational Algebra Operations from Set Theory  
  Binary Relational Operations: JOIN and DIVISION  
  Aggregate functions and Grouping  
• Database Design Theory and Normalization  
 o Informal Design Guidelines for Relation Schemas  
 o Functional Dependencies  
 o Normal Forms Based on Primary Keys  
 o General Definitions of Second and Third Normal Forms  
 o Boyce-Codd Normal Form  
 o Multi-valued Dependencies and a Fourth Normal Form  
 o Join Dependencies  
 o Fifth Normal Form  
• Transaction Processing and Concurrency Control  
 o Introduction to Transaction Processing  
 o Transaction and System Concepts  
 o Desirable Properties of Transactions  
 o Characterizing Schedules Based on Recoverability  
 o Characterizing Schedules Based on Serializability  
 o Two-Phase Locking Techniques for Concurrency Control  
 o ARIES Recovery Algorithm  
• NoSQL  
 o Overview of NoSQL  
 o Characteristics of NoSQL  
 o NoSQL storage types  
 o Advantages and Drawbacks of NoSQL  
 o Case Study: Application definition, Requirement Analysis, Implementation using MongoDB, Database Queries, Writing Queries  
• Vector Database  
 o Introduction  
 o Vector Index  
 o Working of Vector database

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• Database Management Systems  
 o Introduction to DBMS  
  Purpose of Database System  
  Views of data  
  Data models  
  Database management system  
  Three-schema architecture of DBMS  
  Components of DBMS  
 o E/R Model  
  Conceptual data modelling  
  Motivation  
  Entities  
  Entity types  
  Attributes  
  Relationships  
  Relationship types  
  E/R diagram notation  
  Examples  
 o Relational Model  
  Concept of relations  
  Schema-instance distinction  
  Keys  
  Referential integrity and foreign keys  
  Relational algebra operators  
  SQL  
  Introduction  
  Data definition in SQL  
  Table, key and foreign key definitions  
  Update behaviours  
  Querying in SQL  
  Notion of aggregation  
  Aggregation functions  
  Group by and having clauses  
  Embedded SQL  
 o Database Design  
  Dependencies and Normal forms  
  Dependency theory  
  Functional dependencies  
  Armstrong's axioms for FD's  
  Closure of a set of FD's  
  Minimal covers  
  Definitions of 1NF, 2NF, 3NF and BCNF  
  Decompositions and desirable properties of them  
  Algorithms for 3NF and BCNF normalization  
  4NF and 5NF  
 o Transactions  
  Transaction processing and Error recovery  
  Concepts of transaction processing  
  ACID properties  
  Concurrency control  
  Locking based protocols for CC  
  Error recovery and logging  
  Undo, redo, undo-redo logging and recovery methods  
 o Implementation Techniques  
  Data Storage and Indexes  
  File organizations  
  Primary, secondary index structures  
  Various index structures  
  Hash-based  
  Dynamic hashing techniques  
  Multi-level indexes  
  B+ trees  
• Database Management Systems Lab  
 o Use of SQL syntax: insertion, deletion, join, updation using SQL  
 o Programs on join statements and SQL queries including where clause  
 o Programs on procedures and functions  
 o Programs on database triggers  
 o Programs on packages  
 o Programs on data recovery using check point technique  
 o Concurrency control problem using lock operations  
 o Programs on ODBC using either VB or VC++  
 o Programs on JDBC  
 o Programs on embedded SQL using C / C++ as host language  
• Digital Learning Resources  
 o Fundamentals of Database Systems  
  Course Link: https://nptel.ac.in/courses/106/104/106104135/  
  Course Instructor: Dr. Arnab Bhattacharya, IIT Kanpur  
 o Introduction to Database Systems  
  Course Link: https://nptel.ac.in/courses/106/106/106106220  
  Course Instructor: Prof. P. Sreenivasa Kumar, IIT Madras  
 o Virtual Lab  
  Link: http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

IIITB\_Course\_Catalog.pdf

• Introduction to Databases  
 o Database and database users  
 o Database system concepts and architectures  
• Conceptual Data Modeling and Database Design  
 o Data modeling using the entity-relationship (ER) model  
 o Introduction to conceptual modeling  
 o Entity relationship models  
 o UML class diagrams  
• Relational Databases  
 o Relational data model  
 o Database design concepts  
 o DB design via OR mapping  
 o Relational algebra  
 o SQL tutorial  
 o Functional dependencies  
 o Overview of normal forms (till BCNF)  
 o Relational database constraints  
 o Basic SQL  
 o Queries  
 o Triggers  
 o Views and schema modification  
• Database Design Theory and Normalization  
 o Basics of functional dependencies  
 o Normalization for relational databases  
 o Relational database design algorithms  
• File Structures, Hashing, Indexing, and Physical Database Design  
 o Disk storage  
 o Basic file structures  
 o Hashing  
 o Modern storage architectures  
 o Indexing structure for files  
 o Physical database design  
• Query Processing and Optimization  
 o Strategies for query processing  
 o Query optimization  
• Transaction Processing, Concurrency Control, and Recovery  
 o Introduction to transaction processing  
 o Concurrency control techniques  
 o Database recovery techniques  
 o ACID properties  
 o Concurrency control – schedules  
 o Serializability  
 o Deadlocks  
• DBMS Components  
 o Components of a DBMS  
 o Storage structures – primary, clustering, secondary, multi-level  
 o Query processing – overview  
 o Query transformation  
 o Query evaluation  
• Other Data Management Technologies  
 o Data exchange  
 o In-memory databases  
• Other Topics  
 o Data warehouse  
 o Analytics

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• Database Management Systems  
 o Introduction to Database systems  
 o Data Independence  
 o Data Models  
 o Levels of abstraction  
 o Structure of DBMS  
 o Relational Model  
 o Integrity constraints  
 o Relational Languages  
 o Query Languages: SQL, QUEL, QBE  
 o Aggregate operators  
 o Embedded and Dynamic SQL  
 o File Organization  
 o Storage  
 o Buffer management  
 o Record and page formats  
 o File organization techniques  
 o Indexing  
 o Query optimization  
 o Query processing on various operations  
 o Translating SQL queries  
 o Estimating the cost  
 o Database design  
 o E-R Model  
 o Functional dependencies  
 o Normalization  
 o Multi-valued dependencies  
 o Concurrency control and recovery  
 o Transaction  
 o Schedules  
 o Lock based concurrency  
 o Lock management  
 o Concurrency control without locking  
 o Crash recovery  
 o Log  
 o Check pointing  
 o Media recoveries  
 o Database Security  
 o Distributed databases design  
 o Object Oriented database design & its implementation  
 o Introduction to recent advances in database technology  
• Database Laboratory  
 o Study of SQL syntax  
 o Study of Oracle syntax  
 o Study of DB2 syntax  
 o Writing Views  
 o Assertions  
 o Triggers  
 o PL/SQL Programs  
 o Generating forms and reports  
 o Designing and querying databases using SQL  
 o Oracle and DB2: Order processing, insurance, student enrollment, library, banking enterprise  
 o Primary keys, data types and relevant queries  
 o Front end creation using VB, Java  
• Health Informatics  
 o Database management  
 o Introduction to data structure  
 o Elements, arrays, records, sets, tables  
 o Singly and doubly linked data  
 o Stacks, queues and trees  
 o Architecture of DBMS  
 o Representation of data  
 o Physical record interface  
 o Data models: relational, Hierarchical and network approach  
 o Data modeling techniques: relational, Hierarchical and network normalization techniques  
 o Data indexing and structuring techniques  
 o Integrity and security of database  
 o Information searching and retrieval  
 o Hospital information system  
 o Computerized hospital information system  
 o Computerized patient database management  
• Hospital Engineering and Information System  
 o Hospital Information system  
 o Role of database  
 o Need & Overview of Networking  
 o Topologies and its configuration  
 o Structuring medical records  
 o Computerization in pharmacy & billing  
 o Automated clinical laboratory systems & radiology information system