ICS 3101:

ourse Outline
dvanced Database Systems

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- ICS 3101: Advanced Database Systems
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E-Learning Access

- Course Name:**ICS 3101:Advanced Database Systems(April-2023)**
- Enrolment Key :**DBFT2023**
- **Notes ,Class lecture Audio and recommended books**

Learning Outcomes

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Evaluate and analyze	Evaluate and analyze the issues and techniques relating to concurrency control and recovery in a multi-user database environment.
Apply	Apply advanced topics of distributed database management, Indexing, Query Processing and optimization, object-oriented database management, OLAP, OLTP, data warehousing and data mining.
Demonstrate	Demonstrate competent skills in a database production environment and perform standard DBA roles **(Advanced SQL and NoSQL)**
Develop	Develop **a data warehouse** using database technologies

Course Content

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1.Disk storage, Organization and Hashing

2.Indexing structures for files(B-trees, B+ Trees multilevel indexing etc)

3.Query Processing and Optimization

Content Continued..

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4.Cost estimation and algorithms for query optimization

5.Advanced SQL and NoSQL Concepts

Stored procedures, triggers and functions

6.Structured and Unstructured Data

Course Content Continued..

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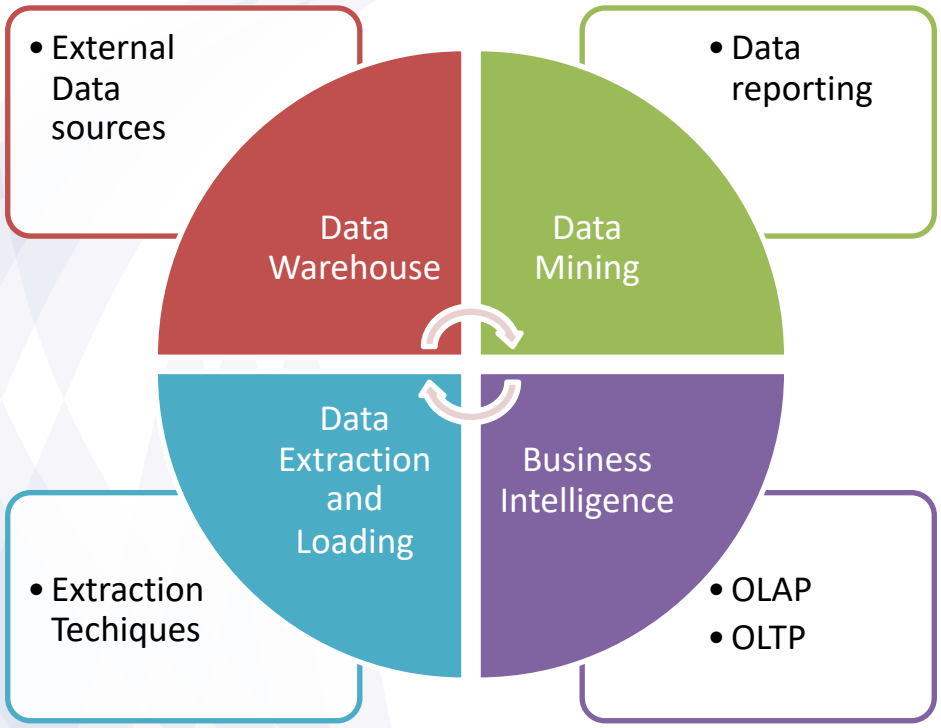

Week 1&2: **Data Storage Disk Access/Organization and Hashing**

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- ✓ **Define** a storage structure(Magnetized disks and storage block)
- ✓ **Explain** the role played by **main memory**, **secondary storage**, and tertiary storage in database systems
- ✓ Explain **block transfer time**, **rotational delay, seek time** and **delay latency**
- ✓ Calculate the **transfer rates, rotational delays** and the **disk capacity,** given the disk requirement.
- ✓ **Differentiate** between **Direct-Attached Storage** (DAS), Network Attached Storage (NAS), and a **Storage Attached Network** (SAN)
- ✓ **Differentiate** between **heap files** and **sorted files and Hashing Techniques**

Week 3:**Indexing Structure for files**

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- ✓ **Describe** the relationship between indexes and **response-time latency**
- ✓ **Differentiate** between **clustered** and u**nclustered** indexes
- ✓ **Differentiate** between **sparse** indexes and **dense** indexes
- ✓ **Define** a **multilevel** index
- ✓ Dynamic multilevel indexing using **B-trees** and **B+ trees**
- ✓ **Explain** the demerits of overusing indexes
- ✓ **Create** different types of indexes using SQL
- ✓ **Calculate** the space required when using different kinds of indexes

Week 4: **Query Processing and Optimization**

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- ✓ **Define** query processing
- ✓ **Explain** the genesis of and the principles of query design, including the use and application of **relational algebra** and as a conduit to creating effective and efficient queries
- ✓ **Decompose** and semantically **analyze** a query
- ✓ **Represent** a query using **a relational algebra tree (query tree)**
- ✓ **Identify** database statistics used to estimate the **cost of operations** in a query
- ✓ **Evaluate** the **computational cost** of relational algebra operations
- ✓ **Design** query operations that minimize resource usage

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Week 5:Algorithms for Query Processing and Optimization

- ✓ **Translate** SQL Queries into Relational Algebra
- ✓ **Examine** Algorithms for External Sorting
- ✓ **Classify** Algorithms for SELECT and JOIN Operations
- ✓ **Examine** Algorithms for PROJECT and SET Operations
- ✓ **Implement** Aggregate Operations and Outer Joins
- ✓ **Combine** Operations using Pipelining
- ✓ **Use Cost** and **Heuristics** in Query Optimization

Week 6:**Advanced SQL**

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- ✓ **Define** an active element in SQL
- ✓ **Define** a **trigger**, a **stored procedure**, and a **function** in the context of a database
- ✓ **Define** a chain reaction in trigger execution
- ✓ **Apply** predicates, operators, and expressions in SQL
- ✓ **Create** triggers, stored procedures, and functions in SQL
- ✓ **Create** views in SQL (Define a relation using a query over other relations)

Week 7:**Introduction to No SQL**

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- ✓ **Define** No –only SQL databases
- ✓ **Describe** Characteristics of NoSQL
- ✓ **Use** No SQL databases
- ✓ **Describe** different types of NoSQL

Week 8: **Structured and Semi-structured Data**

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- ✓ **Differentiate** between structured, semi-structured, and unstructured data
- ✓ **Define** the different types of data models that exist (relational, hierarchical, network, etc.)
- ✓ **Explain** the relationship between structured, semi-structured, and unstructured data and the different data models that exist
- ✓ **Appreciate** the need to expand your view of what constitutes data in today's businesses

Week 9:**Transaction,Concurrency and Recovery Techniques**

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- ✓ **Characterizing** Schedules based on Recoverability
- ✓ **Characterizing** Schedules based on Serializability
- ✓ Database **Recovery tools** and Techniques

Week 10,11&12:**Data Mining Concepts**
Overview of Data warehousing and OLAP

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- ✓ **Differentiate** between **OLTP, OLAP**, and **hybrid (OLTP+OLAP)** systems
- ✓ **Explain** the benefits of **OLAP systems**
- ✓ **Explain** the relationship between **OLAP systems** and **data warehousing**
- ✓ **Describe** the **Extract-Transform-Load (ETL)** process in data warehousing
- ✓ **Differentiate** between **OLAP and data mining**
- ✓ **Appreciate** the prerequisite knowledge required for business intelligence
- ✓ **Searching** large amounts of sample business databases to find useful **patterns and trends**
- ✓ **Create** a **data warehouse**

Core Reading Materials

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- **Fundamentals of Database Systems**. 6th Edition, Ramez Elmasri and Shamkant B. Navathe, Addison-Wesley Pub Co, 1994, ISBN: 0805317481
- **Database Systems:** A Practical Approach to Design, Implementation, and Management, Thomas M. Connolly, Carolyn E. Begg, Addison-Wesley Pub Co, ISBN: 0201342871
- **Recommended Reference Materials**
- Oracle RDBMS books and documentation, Ref www.oracle.com
- Oracle 12c documentation

Course Assessment

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- Examination 60%
- Continuous Assessment and project 40%
- **Total** **100%**

Communication Channels

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- E-Learning
- Module Leader/Class Rep
- Email

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End

Any Questions?