

**IDER UNIVERSITY
EMPASOFT INSTITUTE OF TECHNOLOGY
DEPARTMENT OF SOFTWARE ENGINEERING**

COURSE CURRICULUM

DATABASE MANAGEMENT SYSTEMS

Course code: E.MBM231
Course level: Bachelors degree (Professional course)
Course credits: 3 credits
Course seasons: Fall, Spring each year

Course curriculum developed by:
Instructor: Tsend-Ayush.SH (M.Sc)

Course curriculum approved by:
Head of Department: Baatar Ts. (M.Sc)

**ULAANBAATAR
2024**

| COURSE CURRICULUM | | | |
|--|---|------------------------------|----------------------------------|
| Course name | Database Management Systems | | |
| Course code | E.MBM231 | Course credits | 3 |
| Branch | Software Engineering | School Name | Empasoft Institute of Technology |
| Prerequisite course code | E.DBF230 | Parallel course codes | |
| Main instructor | Tsend-Ayush | Room number | 903 |
| Email address | Tsend-Ayush.sh@novelsoft.mn | Phone number | 99030739 |
| Assistant teacher | | | |
| Total Course Hours | Total: 144 course hours Lecture (32 h), Seminar (32 h), Assignment (80 h) | | |
| Course Type | <input checked="" type="checkbox"/> Must <input type="checkbox"/> Must, Elective <input type="checkbox"/> Elective <input type="checkbox"/> Other | | |
| Season | <input checked="" type="checkbox"/> Autumn <input checked="" type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Every season | | |
| READING MATERIALS: (Course book, magazine, links etc..) | | | |
| Course books | | | |
| <ul style="list-style-type: none"> Lemahieu, W., Broucke, S., & Baesens, B. <i>“Principles of Database Management”</i>. 1st ed. Cambridge University Press. 2018. ISBN-13: 978-1107186125. Elmasri, R., & Navathe, S. <i>“Fundamentals of Database Systems.”</i>. 7th ed. Pearson, 2015. ISBN-13: 978-0133970777. | | | |
| COURSE DESCRIPTION | | | |
| <p>The course covers what is database management, database management systems, its classification, how to organize data, structured and unstructured databases, database architecture, advanced-level SQL and management, transaction management, file-type databases and their management, working with and processing big data, database storage and processing, data governance, capacity management, integration, BI, and analytics.</p> | | | |
| COURSE OUTLINE, Time allocation | | | |
| Main subject in lectures: | | | hours |
| 1. Fundamentals of Database Management <ul style="list-style-type: none"> What is database management? Importance and applications of database management | | | 2 |
| 2. Architecture of Database Management Systems <ul style="list-style-type: none"> Difference between OLTP and OLAP Relational Databases (RDBMS) Types of NoSQL databases (Document, Key-Value, Columnar, Graph) | | | 2 |
| 3. Database Design and Modeling <ul style="list-style-type: none"> Entity-Relationship Diagram (ERD) Principles of data modeling Normalization stages (1NF, 2NF, 3NF) | | | 2 |
| 4. Big Data and Data Warehousing <ul style="list-style-type: none"> Introduction to Big Data Basic concepts of Data Warehouse Overview of technologies like Hadoop and Spark | | | 2 |

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| 5. Data Analysis and Visualization Basics <ul style="list-style-type: none"> • Stages of data analysis • Fundamentals of data visualization tools like Tableau and Power BI • Principles of selecting appropriate visualizations | 2 |
| 6. Visualizing Data with Charts <ul style="list-style-type: none"> • Methods for creating bar, line, pie, and column charts • Visualizing data trends: Time Series, Scatter plot • Interactive Dashboards | 2 |
| 7. Data Analytics <ul style="list-style-type: none"> • Types of analytics: Descriptive, Predictive, Prescriptive • Data clustering and segmentation | 2 |
| 8. Data Preparation and Cleaning <ul style="list-style-type: none"> • Methods for preparing and cleaning data • Handling missing data and outliers | 2 |
| 9. Advanced Analytical SQL <ul style="list-style-type: none"> • Performing analytics using queries • Aggregate Functions, Window Functions • Rank, Complex Joins, Subqueries, CTE (Common Table Expressions) | 2 |
| 10. Advanced Data Visualization <ul style="list-style-type: none"> • Dynamic data analysis • Data storytelling | 2 |
| 11. Data Integration <ul style="list-style-type: none"> • Principles of integrating data sources • ETL (Extract, Transform, Load) process | 2 |
| 12. Data Streaming <ul style="list-style-type: none"> • Managing data streams • Overview of tools like Kafka and RabbitMQ • Strategies for processing real-time data | 2 |
| 13. Distributed Databases <ul style="list-style-type: none"> • Characteristics of distributed databases • Methods for storing distributed data • CAP (Consistency, Availability, Partitioning) | 2 |
| 14. Database Security <ul style="list-style-type: none"> • Methods for securing data • Access control and encryption • Data privacy and rights management | 2 |
| 15. Database Backup and Recovery <ul style="list-style-type: none"> • Types of backups: Full, Incremental, Differential • Recovery strategies and disaster recovery • Automating backups | 2 |
| 16. Data Quality <ul style="list-style-type: none"> • Key indicators of data quality • Monitoring quality in data processing • Tools for improving data quality | 2 |
| Subjects in lab hours: | hours |

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| 1. Discuss what database management is and how to process data. Create a small database and input initial data. | 2 |
| 2. Explain the difference between OLTP and OLAP systems with examples. Install MongoDB and input JSON data (NoSQL data). Provide an example of a Key-Value database using Redis. | 2 |
| 3. Draw an Entity-Relationship Diagram (ERD) using DB Designer. Create relationships (Relations) in MySQL: Set up Primary Key and Foreign Key, and perform normalization (1NF-3NF). | 2 |
| 4. Create a Data Warehouse in MySQL by consolidating small tables. | 2 |
| 5. Import SQL data into Tableau and create basic charts (Bar Chart, Line Chart). Select appropriate visualizations for data representation. | 2 |
| 6. Create Time Series and Scatter Plot charts in Tableau, prepare an interactive dashboard, and identify business problems based on data. | 2 |
| 7. Perform Descriptive and Predictive analytics in Tableau, and experiment with Cluster Analysis. | 2 |
| 8. Use Tableau's Data Interpreter to identify and fix Missing Data and Outliers. Create new data using Calculated Fields. | 2 |
| 9. Use Window Functions and Aggregate Functions, write Rank, Complex Joins, and Subqueries, and create tables using Common Table Expressions (CTE). | 2 |
| 10. Set up Dynamic Filtering and Advanced Actions in Tableau. Create Bullet Graphs and Box & Whisker Plots. Use Tableau Storyline to develop data storytelling. | 2 |
| 11. Test the ETL process using Tableau Prep. Integrate data sources (CSV, MySQL), remove duplicates, and create consolidated data. | 2 |
| 12. Build and test data flows in Tableau Prep. | 2 |
| 13. Connect MongoDB to Tableau and perform data analysis. | 2 |
| 14. Implement access control in MySQL (GRANT, REVOKE) and explore data encryption methods. | 2 |
| 15. Perform Full Backup in MySQL and test the data recovery process. | 2 |
| 16. Measure data quality metrics, write queries to detect data errors, and provide examples of improving data quality using Tableau Prep. | 2 |
| COURSE LEARNING OUTCOMES | Related PLOs |
| Students will gain the following skills after attending the lectures and labs: | |
| 1. How to ensure data quality and have an understanding of data governance. <i>(Apply)</i> | A2 |
| 2. Get an understanding of how we store, back up and recycle our data <i>(Apply)</i> | A3 |
| 3. Choose a database management system based on your needs <i>(Apply)</i> | B1 |
| 4. Understanding the architecture of the database <i>(Apply)</i> | B3 |
| 5. Conducting research on big data processing systems <i>(Execute)</i> | D1 |
| 6. Learn to manage the selected database management system during the course <i>(Execute)</i> | D3 |
| 7. Determine the management methodology of the database <i>(Apply)</i> | D6 |
| TEACHING-LEARNING-ASSESSMENT | |
| Course hour details : (2:2:0:5)-1x2 lecture hours, 1x2 seminar hours. It combines traditional and active teaching methods in the form of lectures and laboratories. | |

| Pedagogy | Training types | Related CLOs | |
|-------------------------|---|---------------------|---------------------|
| Project based training | <ul style="list-style-type: none"> • Lectures • Labs • Assignments | 1-5,7 | |
| Testing based training | | 3, 5, 6 | |
| ASSESSMENT | | | |
| Methods | Periods | Percentages | Related CLOs |
| • Attendance | Weekly | 10% | 1-4 |
| • Active participation | Weekly | 20% | 1-4,7 |
| • Assignment completion | At the 7th week | 20% | 5, 6 |
| • Research works | At the 15th week | 20% | 3, 5, 6 |
| • Midterm & Final Exams | Exam weeks | 30% | 1-4,7 |