Title (Units): **COMP2016 Database Management (3,3,1)**

Course Aims: To introduce how to represent data in a database for a given application and how to manage and use a relational database management system (RDBMS). Topics include: entity-relationship model, relational data model, relational algebra, structured query language SQL and relational database design. In addition, hands-on RDBMS experience is included.

Prerequisite: COMP2045 Programming and Problem Solving

Anti-requisite: ISEM3006 Data Management in Business

Course Intended Learning Outcomes (CILOs):
Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Describe fundamental elements of a relational database management system
2	Explain the basic concepts of relational data model, entity-relationship model, relational algebra, structured query language SQL and relational database design
3	Identify other data models such as semi-structured model and NoSQL model
	Professional Skill
4	Design entity-relationship diagrams to represent database application scenarios and convert entity-relationship diagrams into relations
5	Populate a relational database and formulate SQL queries on the data
	Attitude
6	Work as a team with a professional attitude towards the development of database applications

Calendar Description: This course introduces how to represent data in a database for a given application and how to manage and use a relational database management system (RDBMS). Topics include: entity-relationship model, relational data model, relational algebra, structured query language SQL and relation database design. In addition, hands-on RDBMS experience is included.

Teaching and Learning Activities (TLAs):

CILOs	Type of TLA
1-4	Students will learn the basic database concepts via lectures, tutorials, and assignments.
5	Students will gain practical experience on a database management system via laboratory sessions.
1-6	Students will work on a group project to develop a database application.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
1	Continuous Assessment	40%	1-6	Continuous assessments are designed to assess students' mastery of the key concepts of database management systems. The continuous assessments include assignments, tests, laboratory work, as well as a group project that covers all learning outcomes.
2	Examination	60%	1-5	Final examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be analysis and skills based to assess the student's ability in understanding and application of database systems.

Assessment Rubrics:

Excellent (A)	• Achieve the first five CILOs, demonstrating a good mastery of both the theoretical and practical aspects of database management • Have a thorough understanding of database system concepts, and be able to explain and highlight the key points of these concepts • Able to build ER diagrams according to all application requirements, convert ER diagrams to relational database schemas correctly, and eliminate all functional dependencies in a database schema via normalization • Able to create, populate, update a relational database in SQL language and formulate database queries in both relational algebra and SQL
Good (B)	• Achieve the first five CILOs, demonstrating a good understanding of both the theoretical and practical aspects of database management • Have a good understanding of database system concepts • Able to build ER diagrams according to most of the application requirements, convert ER diagrams to relational database schemas most correctly, and eliminate most of the functional dependencies in a database schema via normalization • Able to create, populate, update a relational database in SQL language and formulate database queries in both relational algebra and SQL for most cases
Satisfactory (C)	• Achieve most of the first five CILOs, demonstrating a basic level of understanding of the theoretical and practical aspects of database management • Have a basic understanding of database system concepts • Able to build ER diagrams according to some database application requirements, convert some ER diagrams to relational database schemas, and eliminate some functional dependencies in a database schema via normalization • Able to create, populate, update a relational database in SQL language and formulate database queries in both relational algebra and SQL for familiar cases
Marginal Pass (D)	• Achieve most of the first five CILOs, with a minimal level of understanding of the theoretical and practical aspects of database management • Have a minimal level of understanding of database system concepts • Able to conduct database designs using ER diagrams and functional dependency analysis under a very limited number of application scenarios • Able to make updates and queries to a database in SQL language for simple cases
Fail (F)	• Achieve less than three of the CILOs, and have little understanding of the theoretical and practical aspects of database management • Unable to provide solutions to simple problems which require basic understanding of database system concepts • Unable to conduct database designs using ER diagrams and functional dependency analysis • Have little understanding of relational algebra and SQL language and have difficulty in applying them to manipulate a database

Course Content and CILOs Mapping:

Content		**CILO No.**
I	Overview of Database Systems	1
II	Entity-Relationship Data Model	2, 4, 6
III	Relational Data Model and Relational Algebra	2, 4, 6
IV	Relational Database Language	2, 5, 6
V	Relational Database Design	2
VI	Other Data Models	3

References:

- Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2003.

- Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, 7th Edition, McGraw Hill, 2019.
- Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Addison Wesley, 2016.
- Hector Garcia-Molina. Database Systems: The Complete Book, 2nd Edition, Prentice Hall, 2014.
- Carlos Coronel and Steven Morris. Database Systems: Design, Implementation, & Management, 13rd Edition, Course Technology, 2018.

Course Content:

Topic

I. Overview of Database Systems
   A. Database system concepts
   B. DBMS and its components
   C. Data independence

II. Entity-Relationship Data Model
   A. Elements of the ER model
   B. Conceptual design with the ER model
   C. Modeling of constraints

III. Relational Data Model and Relational Algebra
   A. Relational model concepts
   B. Relational model constraints
   C. Mapping from ER diagrams to relations
   D. Relational Algebra

IV. Relational Database Language
   A. SQL data definition and data types
   B. Defining a relation schema in SQL
   C. Queries and updates in SQL
   D. Views in SQL

V. Relational Database Design
   A. Functional dependencies
   B. Normal forms and normalization
   C. Schema refinement in database design

VI. Other Data Models
   A. Semi-structured model
   B. NoSQL model