

COURSE SYLLABUS

1. **COURSE TITLE**

Database Management Systems

2. **COURSE CODE**

COMP3013

3. **PRE-REQUISITE**

COMP1013 Structured Programming, or
GCIT1013 Foundations of C Programming, or
COMP1023 Foundations of C Programming, or
STAT2043 Structured Programming (for STAT Students), or
COMP3153 C++ Programming Language

4. **CO-REQUISITE**

Nil

5. **NO. OF UNITS**

3

6. **CONTACT HOURS**

42

7. **OFFERING UNIT**

Applied Mathematics Programme, Computer Science and Technology Programme, Data Science Programme, Financial Mathematics Programme, Statistics Programme, Division of Science and Technology

8. **SYLLABUS PREPARED & REVIEWED BY**

Prepared by: Dr. Weifeng SU

Reviewed by: Dr. Judy FENG & Dr. Sherry ZHOU, Dr. Huajun YE

9. **AIMS & OBJECTIVES**

This course provides how to represent the data in a database for a given application and how to manage and use a database management system. Topics include: conceptual modeling of a database, relational data model, relational algebra, database language SQL, relation database design, and emerging XML data model. In addition, hands-on DBMS experience is included.

10. **COURSE CONTENT**

I. Overview of Database Systems	2
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- A. Database System Concepts
- B. DBMS and Its Components
- C. Database Architectures
- D. Data Independence
- II. The Entity-Relationship Data Model 3
 - A. Elements of the ER Model
 - B. Conceptual Design with the ER Model
 - C. Modeling of Constraints
- III. The Relational Data Model and Relational Algebra 14
 - A. Relational Model Concepts
 - B. Relational Model Constraints
 - C. Mapping from ER Diagrams to Relational
 - D. Relational Database Schemas
 - E. Views
 - F. Relational Algebra
- IV. Relational Database Language 8
 - A. SQL Data Definition and Data Types
 - B. Queries and Updates in SQL
 - C. Defining a Relation Schema in SQL
 - D. Views in SQL
- V. Relational Database Design 8
 - A. Functional Dependencies
 - B. Normal Forms and Normalisation
 - C. Schema Refinement in Database Design
- VI. Other Data Models 5
 - A. Object-Oriented Model
 - B. Semi-structured Data – XML

11. COURSE INTENDED LEARNING OUTCOMES (CILOS) WITH MATCHING TO PILOS

For AM Students:

Programme Intended Learning Outcomes (PILOs)

Programme Title: Bachelor of Science (Honours) in Applied Mathematics	
PILO	Upon successful completion of the Programme, students should be able to:
PILO 1	Evaluate the principles, concepts and theories of fundamental mathematics.

Programme Title: Bachelor of Science (Honours) in Applied Mathematics	
PILO	Upon successful completion of the Programme, students should be able to:
PILO 2	Identify problems solvable by applied mathematics in business or other fields and develop critical solutions using appropriate academic and professional knowledge.
PILO 3	Use mathematical software and computer programming/algorithms to solve problems in scientific, engineering, business and other practical fields.
PILO 4	Develop appropriate mathematical models and enhance performance of such models through comparisons and refinements of alternative approaches.
PILO 5	Communicate and practice effectively as a professional mathematician both in team and independent working context.

CILOs-PILOs Mapping Matrix

Course Code & Title: COMP3013 Database Management Systems		
CILO	Upon successful completion of the course, students should be able to:	PILO(s) to be addressed
CILO 1	write relational algebra and SQL queries to retrieve information from a database proficiently;	PILO 3
CILO 2	design a relational database management system;	PILO 3
CILO 3	write discipline-related documents for a project to be presented; and	PILO 5
CILO 4	collaborate in a team.	PILO 5

For CST Students:

Programme Intended Learning Outcomes (PILOs)

Programme Title: Bachelor of Science (Honours) in Computer Science and Technology	
PILO	Upon successful completion of the Programme, students should be able to:
PILO 1	analyse the basic principles of computer science and technology;
PILO 2	translate real world problems into IT requirements;
PILO 3	design and develop complex software;
PILO 4	apply up-to-date technology to solve general problems in specific areas;
PILO 5	communicate effectively and collaborate in a team.

CILOs-PILOs Mapping Matrix

Course Code & Title: COMP3013 Database Management Systems		
CILO	Upon successful completion of the course, students should be able to:	PILO(s) to be addressed
CILO 1	write relational algebra and SQL queries to retrieve information from a database proficiently;	PILO 1
CILO 2	design a relational database management system;	PILOs 2,5

Course Code & Title: COMP3013 Database Management Systems		
CILO	Upon successful completion of the course, students should be able to:	PILO(s) to be addressed
CILO 3	write discipline-related documents for a project to be presented; and	PILO 5
CILO 4	collaborate in a team.	PILO 5

For DS Students:

Programme Intended Learning Outcomes (PILOs)

Programme Title: Bachelor of Science (Honours) in Data Science	
PILO	Upon successful completion of the Programme, students should be able to:
PILO 1	Describe and explain the fundamental knowledge required to support the study and applications of Data Science;
PILO 2	Competently apply a wide range of programming concepts to software development in data collection and analysis;
PILO 3	Formulate novel methods in data information gathering and analysis to solve real world problems;
PILO 4	Collaborate and function effectively in team work with proficient communication and effective interpersonal skills;
PILO 5	Stay abreast of contemporary issues in Data Science and develop life-long effective learning skills to meet the needs of the Data Science discipline.

CILOs-PILOs Mapping Matrix

Course Code & Title: COMP3013 Database Management Systems		
CILO	Upon successful completion of the course, students should be able to:	PILO(s) to be addressed
CILO 1	write relational algebra and SQL queries to retrieve information from a database proficiently;	PILO 1, 2
CILO 2	design a relational database management system;	PILO 2
CILO 3	write discipline-related documents for a project to be presented; and	PILO 2
CILO 4	collaborate in a team.	PILO 4

For FM Students:

Programme Intended Learning Outcomes (PILOs)

Programme Title: Bachelor of Science (Honours) in Financial Mathematics	
PILO	Upon successful completion of the Programme, students should be able to:
PILO 1	Apply the basic principles of financial mathematics to clearly

Programme Title: Bachelor of Science (Honours) in Financial Mathematics	
PILO	Upon successful completion of the Programme, students should be able to:
	explain the phenomena and problems in financial markets;
PILO 2	Interpret quantitative models for pricing derivatives, managing trading strategies and simulating market scenarios;
PILO 3	Employ theories and tools of financial mathematics for the construction of the financial product, asset pricing and risk management;
PILO 4	Use mathematical and financial software to perform computation of financial data analysis and pricing and valuation of financial instruments;
PILO 5	Conduct independent research in financial management and exploring business opportunities in financial markets;
PILO 6	Develop the capacity to work as part of a team.

CILOs-PILOs Mapping Matrix

Course Code & Title: COMP3013 Database Management Systems		
CILO	Upon successful completion of the course, students should be able to:	PILO(s) to be addressed
CILO 1	write relational algebra and SQL queries to retrieve information from a database proficiently;	PILO 1
CILO 2	design a relational database management system;	PILOs 2,6
CILO 3	write discipline-related documents for a project to be presented; and	PILO 6
CILO 4	collaborate in a team.	PILO 6

For STAT Students:

Programme Intended Learning Outcomes (PILOs)

Programme Title: Bachelor of Science (Honours) in Statistics.	
PILO	Upon successful completion of the Programme, students should be able to:
PILO 1	Evaluate the principles, concepts and theories of statistics, operations research and actuarial science;
PILO 2	Independently analyse real world/professional problems and develop the critical solutions, underpinned by academic and professional knowledge.
PILO 3	Proficiently use statistical and mathematical software to solve a range of problems in scientific, engineering, commercial and other practical applications;
PILO 4	Quantitatively compare with alternative approaches and develop mathematical and statistical models, in order to enhance the performance and reliability of such models.
PILO 5	Communicate and practice effectively as a professional both in team and independent working context.

CILOs-PILOs Mapping Matrix

Course Code & Title: COMP3013 Database Management Systems
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CILO	Upon successful completion of the course, students should be able to:	PILO(s) to be addressed
CILO 1	write relational algebra and SQL queries to retrieve information from a database proficiently;	PILO 2
CILO 2	design a relational database management system;	PILOs 2,3
CILO 3	write discipline-related documents for a project to be presented; and	PILOs 3,5
CILO 4	collaborate in a team.	PILO 5

12. TEACHING & LEARNING ACTIVITIES (TLAS)

CILO No.	TLAs
CILO 1	<ul style="list-style-type: none"> ● Lecture: The instructor will explain the course material in detail. ● Assignment: Each student is required to independently work on 2 assignments. ● Quizzes: Each student will take two quizzes. ● Hands-on practice: The instructor will arrange tutorials in labs where each student can practice database operations on actual database management systems. ● Project: Each student is required to join a group to complete and implement a database design for a concrete application. In such a project, a student needs to draw the ER diagrams for the application, convert the diagrams to relational tables, perform the necessary normalisation, and implement the final tables in a database management system.
CILO 2	<ul style="list-style-type: none"> ● Lecture: The instructor will explain the course material in detail. ● Assignment: Each student is required to independently work on 2 assignments. ● Quizzes: Each student will take two quizzes. ● Hands-on practice: The instructor will arrange tutorials in labs where each student can practice database operations on actual database management systems. ● Project: Each student is required to join a group to complete and implement a database design for a concrete application. In such a project, a student needs to draw the ER diagrams for the application, convert the diagrams to relational tables, perform the necessary normalisation, and implement the final tables in a database management system.
CILO 3	<ul style="list-style-type: none"> ● Project: Each student is required to join a group to complete and implement a database design for a concrete application. In such a project, a student needs to draw the ER diagrams for the application, convert the diagrams to relational tables, perform the necessary normalisation, and

CILO No.	TLAs
	implement the final tables in a database management system.
CILO 4	<ul style="list-style-type: none"> ● Project: Each student is required to join a group to complete and implement a database design for a concrete application. In such a project, a student needs to draw the ER diagrams for the application, convert the diagrams to relational tables, perform the necessary normalisation, and implement the final tables in a database management system.

13. ASSESSMENT METHODS (AMS)

Type of Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
Assignment	10%	1-2	Students will work on individual assignments to assess the skills they learnt in class.
In-class Exercises	20%	1-2	The in-class exercises will assess the major learning outcomes achieved by students upon half-completion of the course.
Group Project	20%	1-4	The group project will assess the major learning outcomes achieved by students upon completion of the course
Lab	10%	1-2	Students will work on individual lab exercises to practice the SQL skills that they have learned in lectures.
Final Examination	40%	1-2	This final examination aims to assess the major learning outcomes achieved by students upon completion of the course.

14. TEXTBOOKS / RECOMMENDED READINGS

TEXTBOOK:

Nil

RECOMMEND READINGS:

- [1] Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, 5th Edition, McGraw Hill, 2006.
- [2] Jeffrey D. Ullman and Jennifer Widom, A First Course in Database Systems, 2nd Edition, Prentice Hall, 2002.
- [3] Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2003.
- [4] Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 4th Edition, Addison Wesley, 2003.
- [5] C. J. Date, An Introduction to Database Systems, 8th Edition, Addison-Wesley, 2004.
- [6] Ken North, Sets, Data Models and Data Independence, Dr. Dobb's, 10 March 2010.
- [7] Lightstone, S.; Teorey, T.; Nadeau, T. Physical Database Design: the database professional's guide to exploiting indexes, views, storage, and more. Morgan Kaufmann Press, 2007.
- [8] Codd, E.F. (1970). "A Relational Model of Data for Large Shared Data Banks". In: Communications of the ACM 13 (6): 377–387.
- [9] Beynon-Davies P. Database Systems 3rd Edition. Palgrave, Basingstoke, UK, 2004.
- [10] Jeffrey Ullman, First course in database systems, Prentice–Hall Inc., Simon & Schuster, 1997.

15. MEDIUM OF INSTRUCTION (MOD)

English

Revised on: <2021-07-15>