



General Information

Date:	3/18/21	*Effective Term:	Fall 2021
College/Department:	Engineering/Computer Science		
Course Designator and Number (Cross-listed Course Designator and Number):	CS 5614		
Title of Course:	Database Management Systems		
Instructor and/or Department Contact:	Trey Mayo/Director of Graduate Programs		
Contact Phone:		Contact E-mail:	treymayo@vt.edu

Prerequisite Enforced

Enable prerequisite enforcement?  Yes  No

Add the following Prerequisite/Corequisites:

Graduate standing in the CSA program  
*Attach department letter of support to include a non-departmental course as a prerequisite/corequisite.*

Drop the Following Prerequisites/Corequisites:

CS 2604 (UG) OR CS 2604

List Course Prerequisites/Corequisites after change:

Graduate standing in the CSA program

Justification (Justify prerequisite/corequisite changes and remaining prerequisites/corequisites after change)

Student must be admitted to the graduate program in CSA in order to take the course.  
*If adding a minimum grade as a prerequisite for a course, data must be provided to clearly show the need for that minimum grade in order to be successful in the course. Minimum grade requirements may not be used as a way to limit enrollment.*

- \*If request is being processed for the upcoming effective term:
- Requests to **ADD** prerequisite requirements (i.e., turn enforcement **ON**, add grade restriction, add course) must be processed prior to the opening of "course request" for the applicable effective term.
  - Requests to **REMOVE** prerequisite requirements (i.e., turn enforcement **OFF**, remove a grade restriction, drop course) may be completed at any time, unless the removal causes the course to be more restrictive.

Approval Signatures

Department Head/Chair		Date	3/18/2021
College Curriculum Committee Representative		Date	3/19/21
College Dean		Date	3/19/21

**COMPUTER SCIENCE 5614**  
**DATABASE MANAGEMENT SYSTEMS**  
**(ADP TITLE: DATABASE MANAGEMENT SYSTEMS)**

**I. CATALOG DESCRIPTION**

5614      DATABASE MANAGEMENT SYSTEMS

Emphasizes concepts, data models, mechanisms, and language aspects concerned with the definition, organization, and manipulation of data at a logical level. Concentrates on relational model, along with introduction to design of relational systems using Entity-relationship modeling. Functional dependencies and normalization of relations. Query languages, relational algebra, Datalog, and SQL. Query processing, logic and databases, physical database tuning. Concurrency control, OLTP, active and rule-based elements. Data Warehousing, OLAP.

PRE: 2604. (3H, 3C).

**II. LEARNING OBJECTIVES**

Having successfully completed this course, the student will be able to:

- define a data model for a set of data;
- design a normalized set of relations to represent data in a typical application;
- construct queries in relational algebra, Datalog, and SQL;
- identify the internal design structure of a specific representational database management system;
- apply the theoretical principles underlying query processing, database tuning, and plan selection;
- enumerate database concurrency control mechanisms for achieving serializability;
- explore implications of database management systems in non-traditional environments, such as the World Wide Web and enterprise-wide data warehouses, and for emerging applications such as data mining and online analytical processing (OLAP).

**III. JUSTIFICATION**

Database systems play a central role in all information processing activities. Applications cover the spectrum from business to science to engineering. The development of corporate and other institutional databases is one of the most important activities of many organizations. It is important for a computer science curriculum to contain a course that teaches the theory, principles, and practice of database management systems.

The changes described in this proposal consist of a change in prerequisite (4004 is no longer offered) and an update to the syllabus. The field of database management has also evolved in the past few years; the syllabus has been updated and reorganized into four main modules that reflect the major aspects

underlying the design, implementation, and use of database management systems. The texts have also been updated to reflect the changes in syllabus.

#### IV. PREREQUISITES AND COREQUISITES

In addition to the usual catalog statement on prerequisites associated with graduate courses, CS 2604 is specifically listed because students need to have background in file systems, data structures, and fluency in at least one programming language.

#### V. TEXTS AND SPECIAL TEACHING AIDS

**Required text to be chosen from:**

1. Ramakrishnan, Raghu and Johannes Gehrke, DATABASE MANAGEMENT SYSTEMS. New York, NY: McGraw Hill Publishing Company, 1998. xxvi, 741.
2. Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan. DATABASE SYSTEM CONCEPTS. New York, NY: McGraw-Hill, 1999. xxii. 821.
3. Garcia-Molina, Hector, Jeffrey D. Ullman, and Jennifer Widom, DATABASE SYSTEM IMPLEMENTATION. Upper Saddle River, NJ: Prentice Hall, 2000. xv, 653.

#### **Additional Teaching aids**

Course will be based on database projects conducted on ORACLE and using languages such as PL/SQL and Pro\*C.

#### VI. SYLLABUS

	Percent of Course
1. Introduction and Conceptual Design	25
a. Historical Trends	
b. Entity-Relationship Modeling	
c. Relational Model and Normalization	
d. The 3NF, BCNF, and 4NF Normal Forms	
e. Functional Dependencies and Decompositions	
2. Query Processing	25
a. Query Languages: Relational Algebra, Datalog, and SQL	
b. Logic and Databases	
c. Physical Database Tuning	
d. Query Compilation	
e. Plan Selection	
3. Concurrency Control	25
a. Serializable Schedules	

b. Conflicts and Locking Mechanisms	
c. Properties of Locking Mechanisms	
d. Recovery, Logging, and Resolving Deadlocks	
e. OLTP, Active and Rule-Based Elements	
4. Information Integration	25
a. Mediator-Based Approaches	
b. Wrappers	
c. Data Warehousing (including the CUBE operator)	
d. Online Analytical Processing (OLAP)	
e. Data Mining (Brief Mention Only)	
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	100

## VII. OLD (CURRENT) SYLLABUS

	Percent of Course
1. Introduction	5
a. Evolutionary solutions to information problems	
2. Conceptual and semantic modeling	10
a. The Entity-Relationship model	
3. Definition of relational data model	25
a. Properties	
b. Representation of entities, relationships	
4. Relational algebra	10
5. Relational calculus	20
6. Functional dependency and normalization	10
7. Transaction Processing	20
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	100

## VIII. CORE CURRICULUM GUIDELINES

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