ITD 256

Advanced Database Management

Course Syllabus

Instructor	Chris Jones
Sessions	Spring 2025
Meeting (A Day)	None
Meeting (B Day)	8:00 am to 9:24 am
Location	Arlington Career Center, Room TBD
Contact	cmj2310@email.vccs.edu

Course Description

Focuses in-depth instruction in the handling of critical tasks of planning and implementing large databases. Includes an introduction to concepts of advanced data warehousing and database configuration.

General Course Purpose

The purpose of this course is to provide a comprehensive introduction to essential database terms and concepts, efficient relational database design, data normalization and database management. The emphasis of the course is on the design, development, and use of a relational database. The student will learn the basics of drawing an entity-relationship diagram (ERD) to represent user requirements, transform the ERD to a normalized relational design, and then use Structured Query Language (SQL) to implement and work with the database.

Course Prerequisites/Co-Requisites

- College level reading and writing ability

Course Objectives

Upon completing the course, the student will be able to:

1. Define essential database vocabulary
2. Effectively apply data relationships and normalization techniques
3. Describe the transformation of database design from a conceptual user model (e.g., an ERD) to a normalized relational model

4. Explain and apply Structured Query Language (SQL) in a database environment
5. Describe the methods available for minimizing DBMS risks and security failures
6. Characterize the roles and responsibilities of the Database Administrator (DBA)
7. Apply fundamental database concepts to an information systems problem

Major Topics to be Included

1. Basic Database Concepts
2. Relational Database Terms and Concepts
3. Normalization
4. Structured Query Language
5. Data Modeling
6. Database Design
7. Database Management and Administration
8. Business Intelligence / Basic Data Warehousing Concepts

Student Outcomes

Basic Database Concepts

- Define basic database terms and principles
- Discuss why databases are used
- Contrast (traditional) file processing with database processing
- Describe the components of a database as well as a database management system
- Describe the purpose and functions of a database management system (DBMS)

Relational Database Terms and Concepts

- Describe the conceptual foundation of the relational model
- Distinguish between relational and non-relational tables
- Explain basic relational terminology to include, but not limited to, relation/table, tuple/row, attribute/column, cardinality/multiplicity
- Explain the meaning and importance of keys, primary and foreign keys, and related terminology
- Explain how foreign keys and intersection relations represent relationships
- Explain the purpose and use of surrogate/synthetic keys
- Explain the meaning of both entity and referential integrity

Data Modeling

- Describe the basic stages of database development
- Explain the purpose and role of a data model
- Describe the principal components of the entity-relationship (ER) data model
- Interpret traditional ER diagrams (ERDs)
- Interpret and construct ER diagrams using Crow's Foot notation
- Represent binary relationships to include 1:1, 1:M, M:N with the ER model
- Explain weak entities and how to use them
- Explain non-identifying and identifying relationships and how to use them
- Create an ER diagram from source documents or specifications
- Explain the concept of object-relational databases

Normalization

- Define normalization
- Explain the motivation behind the use of normalization in database design

- Explain the nature and background of normalization theory
- Apply the normalization process to produce a relation in third normal form (3NF)
- Explain and analyze functional dependencies within tables

Database Design (logical and physical)

- Transform ER data models into relational designs
- Recognize and describe motivations and processes for de-normalization
- Represent weak entities with the relational model
- Represent 1:1, 1:M, and M:N binary relationships

Structured Query Language

- Write basic SQL statements for creating database structures (DDL: CREATE)
- Write basic SQL statements to add data to a database (INSERT)
- Write basic SQL SELECT statements and options for processing a single table
- Write basic SQL SELECT statements for processing multiple tables (JOINs)
- Write basic SQL statements to modify and delete data from a database (UPDATE, DELETE)
- Write basic SQL statements to modify and delete database tables and constraints (DDL: ALTER, DROP)
- Write basic SQL statements for creating and using views
- Explain the reasons for using views

Database Management and Administration

- Describe the need for, and importance of, database administration
- Describe basic administrative and managerial DBA functions
- Describe different ways of processing a database
- Describe the need for concurrency control, security, and backup and recovery
- Describe typical problems that can occur when multiple users interact with a database concurrently
- Explain the use of locking and the problem of deadlock
- Distinguish between optimistic and pessimistic concurrency and list examples of each
- Describe specific design and implementation strategies for improving database security
- Distinguish between recovery by reprocessing and recovery by rollback/rollforward
- Explain the nature of tasks required for recovery using rollback/rollforward
- Explain distributed database processing

Business Intelligence / Basic Data Warehousing Concepts

- Explain the basic concepts of data warehouses, data marts, and dimensional tables
- Explain the basic concepts of business intelligence (BI) systems
- Explain the basic concepts of OnLine Analytical Procession (OLAP) and data mining

Database Project

Given a business case (project scenario), the student will:

- Explain how database principles may be applied as a part of an IT solution
- Draw an ERD to reflect a given set of user requirements and example data
- Transform the initial design/ERD into a 3NF-compliant relational model
- Write the necessary SQL to create database structures (DDL: CREATE) and insert data (DML: INSERT)
- Write the necessary SQL to output data as meaningful query results

Time Allocation Per Topic

In order to standardize the core topics so that a course taught at one campus is equivalent to the same course taught at another campus, the following student contact hours per topic are required. Each syllabus should be created to adhere as closely as possible to these allocations. Of course, the topics cannot be followed sequentially. Many topics are taught best as an integrated whole, often revisiting the topic several times, each time at a higher level. There are normally 45 student-contact-hours per semester for a three credit course. (This includes 15 weeks of instruction and does not include the final exam week so 15* 3 = 45 hours. Sections of the course that are given in alternative formats from the standard 16 week section still meet for the same number of contact hours.) The final exam time is not included in the time table. The category, Miscellaneous, leaves ample time for an instructor to tailor the course to special needs or resources.

Topic	Hours	Percentage
Basic Database Concepts	3	7%
Relational Database Terms and Concepts	4	9%
Data Modeling	6	13%
Database Design	5	11%
Normalization	6	13%
Structured Query Language	11	24%
Database Management and Administration	4	9%
Business Intelligence / Basic Data Warehousing Concepts	3	7%
Other Optional Content	3	7%
Total	45	**100%**

Required Instructional Materials

- None
- Other freely available resources as provided by instructor

Course Credit: 3 Credits

Policies

I. Expectations
   A. This Dual Enrollment class is a rigorous, college level course that will require sustained and consistent engagement from students.
   B. An average of 40 minutes of homework will be assigned for each 90 minutes in class. We will be utilizing a flipped classroom learning environment, where the lecture portion of the course material will be viewed individually at home before class meets, and class time will be used for collaborative engagement and discussion.
   C. Frequent "mini quizzes" at the beginning of class will be used to be sure homework readings and practice have been completed. To be successful in this class, students will be expected to be prepared for these quizzes when they arrive in class.
   D. Our class follows college policies. Late work is not accepted, and retakes are not provided.
   E. To ensure that students understand and are prepared for these expectations, all students are expected to complete a **DE Expectations Contract** at the beginning of the school year. For DE classes that span two semesters, a single contract at the beginning of the school year covers both.

II. Grading Policies
   A. Grading Scale: A= 100 - 90 B= 89 - 80 C= 79 - 70 D=69 - 60 F= 59 and below
   B. Students will receive a weekly cumulative letter grade that will incorporate daily quizzes, tests, projects, and presentations. These weekly evaluations can be challenged by the student, but only during the week immediately following when the evaluation is given.
   C. The average of the weekly evaluations will make up 60% of the final grade, with the course final exam making up 40%.
   D. In cases where district grading policies conflict with college grading policies, the high school and college grades may differ; this may include assignment/test retakes, extended assignment due dates, capped minimum grade allowed, among other such district policies.
   E. It is important that students check their final NOVA grades in SIS as soon as their course is completed.
   F. Course Grade Appeals
      i. Students who think that a semester grade is in error should contact the instructor immediately to present their concerns. Students who wish to appeal their grade or otherwise report a grievance will need to submit Form 125-021 within 20 days of the end of the semester. The original grade will stand if the student delays in submitting their appeal.
      ii. NOVA's Student Grievance policy can be found here: https://www.nvcc.edu/policies/_files/608-Student-Grievances.pdf
      iii. Form 125-021 can be found here: https://www.nvcc.edu/forms/

III. Course Policies
   A. Student Rights and Responsibilities
      i. Students should be familiar with the college's specific expectations concerning the conduct of its students. These expectations apply to all students, including Dual Enrollment students.
      ii. Student Rights and Responsibilities are outlined in the Student Code of Conduct, found here: https://www.nvcc.edu/students/handbook/conduct.html
   B. Academic Integrity
      i. Academic integrity requires that you recognize and acknowledge information derived from others and take credit only for ideas and work that are yours. It should be the guiding principle for all that you do, from taking assessments and making presentations to writing papers. More about academic integrity at NOVA can be reviewed on the Student Conduct and Integrity page on the NOVA website: https://www.nvcc.edu/students/handbook/conduct.html.
      ii. Violating the Academic Integrity Policy will incur consequences. Your instructor may give you a failing grade for the assignment or for the course. Further, you may be referred to NOVA Cares, reported to an academic dean, or even referred to the Dean of Students for disciplinary action depending on how serious an infraction was committed.
      iii. Please review NOVA's Academic Integrity Policy here: https://www.nvcc.edu/policies/_files/224-Academic-Integrity.pdf.
   C. Accommodations and Accessibility Services
      i. NOVA is committed to ensuring all students have an opportunity to pursue a college education regardless of the presence or absence of a disability. Information on NOVA's Accommodations and Accessibility Services, including how to reach a Accommodations and Accessibility Services counselor, can be found here: https://www.nvcc.edu/accommodations.
      ii. Students must reach out to contact NOVA's Accommodations and Accessibility Services to apply for accommodations. A student with a 504 plan or IEP at their high school will still need to apply with NOVA's Accommodations and Accessibility Services – those plans do not automatically carry over to your Dual Enrollment course. If accommodations are agreed upon, students will receive a Memorandum of Accommodation (MOA) by

AAS. All information is kept confidential and may increase your chances of success in the academic setting.

D. Advocacy and Privacy of Student Records
   i. Students are expected to reach out to their instructor if they do not understand content or expectations.
   ii. You, as a NOVA student, have a right to review your NOVA grades and other records. Your high school may share grades and other records with NOVA, and NOVA will share your post-secondary (college) grades with your high school. The grades you earn at NOVA are part of a permanent transcript, and you will be required to include your NOVA transcript as part of any future college or graduate school application. NOVA instructors and other college personnel generally may not release a student's educational records without written consent of the student. For dual enrolled students under 18, parents or guardians may generally access records and grades which are created by or shared with a student's high school. For the purposes of these privacy rules, your Dual Enrollment instructor is considered a NOVA employee.
   iii. To grant parents or guardians direct access to NOVA records, students will be required to submit a notarized copy of NOVA Form 125-356, found here: https://www.nvcc.edu/forms/pdf/125-356.pdf.
   iv. For more information about student privacy, parent limitations of access to students' educational records, and other restrictions on sharing students' personally identifiable information, please review NOVA Policy 613 (FERPA): https://www.nvcc.edu/policies/_files/613-FERPA.pdf.

E. Campus Services
   i. Dual enrolled students have access to full NOVA campus services to include tutoring, library, and counseling services; student resources are found here: http://www.nvcc.edu/students/index.html.

F. Office of Wellness and Mental Health
   i. During your time at NOVA, you may experience challenges including struggles with academics, finances, or your personal well-being. NOVA has support resources available. If you are seeking resources and support or if you are worried about a friend or classmate: https://www.nvcc.edu/wellness/index.html.

G. Course Drop and Withdrawal Policy
   i. Please note two important dates related to your enrollment in a course:
      a. The "Drop" date (also known as census date) for a course is the last day to drop a course. Dropping a course before the drop date will not appear on your NOVA transcript.
      b. The "Withdrawal" date is the last day to withdraw without a grade penalty. Dropping a course after the drop date and before the withdrawal date will result in a 'W' grade appearing on your transcript.
      c. To identify these dates for your dual enrollment course, please see below on the 'Course Schedule' chart or log into your myNOVA account and SIS.
   ii. Withdrawal Process
      a. Dual enrolled students are responsible for requesting to drop or withdraw from their DE classes, using Form 125-03, found at the following link: https://dashboard.nvcc.edu/Forms/125-03
      b. Dual enrolled students will use their myNOVA credentials to access the withdrawal form and will select one or more enrolled DE classes to withdraw.
      c. The withdrawal form is then routed to the assigned DE instructor and the Office of Dual Enrollment for review and approval.
      d. Check your VCCS email for the status of your request.

H. Communication
   i. Students are required to use their VCCS email accounts (_____@email.vccs.edu) to

communicate with college personnel and should check their email accounts regularly. Students may access their VCCS email accounts through myNOVA.

I. Title IX
   i. Title IX is a civil rights law that prohibits discrimination on the basis of sex in educational programs, activities, admission and employment. Complaints of sex-based discrimination, sexual violence, domestic violence, and sexual or gender-based harassment are governed by the Title IX Policy. For more information about Title IX or to make a report: https://www.nvcc.edu/titleix/index.html.

IV. Additional Course Information
   A. DE students are expected to engage in college level course contents and discussions appropriate for adult learners. Mature topics may be discussed.

V. Course Schedule
   A. Critical Course Dates
      - Course Start Date: Monday, February 3, 2025
      - Course Drop Date: Monday, February 24, 2025
      - Course Withdrawal Date: Friday, April 25, 2025
      - Final Exam Date: Week of June 9 to 12, 2025
      - Course End Date: Thursday, June 12, 2025
   B. Final Exam Date: The final exam will be given during the last week of class, between Monday, June 9 and Thursday, June 12.