

**CSCI 6333 Database Design & Implementation**  
**CSCI 6315 Applied Database Systems**  
 Spring 2020  
 Tuesday, 6:30pm-9:00pm, ENGR 1.242

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IEAB 3.241, M&T, 10:00am-12:00pm, 4:00pm-5:00pm

## COURSE DESCRIPTION AND PREREQUISITES

Here are the course descriptions from UTRGV Catalog:

### CSCI 63333 Advanced Database Design and Implementation (3 Credits)

Focuses on distributed database systems. Includes file allocation, directory systems, deadlock detection and prevention, synchronization, query optimization, and fault tolerance. The course will include one or more programming projects demonstrating implementation of concepts introduced. Prerequisite CSCI 6305, or consent of instructor.

### CSCI 6315 Applied Database Systems (3 Credits)

Course covers the application of a modern database system. Concepts covered include relational model, normalization, structured query language, Internet data formats, and server and client side technologies. The course is targeted at students who are interested in the development of application programs using a database system such as Oracle, or Microsoft SQL. Prerequisite CSCI 6302 or equivalent.

I will use Blackboard for this class. Please make sure that you assess Blackboard often for course materials, assignments, and especially submitting your assignments. Assignment deadlines will be enforced by Blackboard.

Additional materials may be available at my web page: <http://faculty.utrgv.edu/zhixiang.chen/>

## LEARNING OBJECTIVES/OUTCOMES FOR THE COURSE

Upon successfully completing the course each student should be able to:

### 1. Knowledge and Comprehension

- a. Discuss the history of data management including file-based systems, 1<sup>st</sup> Generation DBMS, 2<sup>nd</sup> Generation DBMS, & 3<sup>rd</sup> Generation DBMS.
- b. Describe basic DBMS concepts and terminology (database, DDLs, DMLs, DB Roles, system catalog, relation, column, tuple, intension, degree, extension, cardinality, n-tuple, relation schema, relational database schema, relation instance, keys, base/home relation, integrity/domain/general constraints).
- c. Discuss the ANSI-Sparc three-level architecture and discuss how data independence and views affect our interaction with databases.
- d. Draw and discuss different DBMS topologies (teleprocessing, file-server, n-tier).
- e. Describe the characteristics in Relational Algebra & Set Theory that are supported in the Relational Model. Including :
  - i. E. F. Codd, the relational db model & properties of relations
  - ii. Relational Algebra (sets & operators)
- f. Describe the main operations used to define and manipulate a database management system( create, drop, select, insert, update, delete )
- g. Describe the physical level of a database management system, wrt file organizations and optimizations for speeding up search/retrieval (indexes, clusters).
- h. Describe the different stages in designing a database application (conceptual, logical, and physical) and be aware of the importance of documenting each phase of database design.
- i. Describe the purpose and contents of an ER Diagram including:
  - i. how an ER Model improves database design.
  - ii. the importance of understanding the relationships (multiplicity) of the entities

- j. Describe the concept of Normalization and be able to:
  - i. Discuss the anomalies that require normalization of relations.
  - ii. Understand what functional dependencies are and how to identify them.
  - iii. Describe 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Normal Forms of relations.
- k. Describe the basic syntax for programming in a DBMS language (SQL)
- l. Describe the Oracle Physical DB Architecture (database, tablespace, schema, data files, redo log files, control files)

## 2. Application and Analysis

- a. List the main differences between file-based systems and database management systems and understand the issues and advantages of each.
- b. Differentiate between the different DBMS topologies giving their advantages and disadvantages.
- c. Compare different SQL operations and state the advantages they provide (ex. Views vs Queries, Sub-queries vs. Joins)
- d. Compare the advantages of different normalization levels.
- e. Apply the steps to solve physical database issues (e.g., when to increase tablespace size).
- f. Analyze SQL statements and determine the results on the relational database schema that they operate on
- g. Prove that a relation is in 1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup> normal forms.
- h. Differentiate between file indexes and physical file formats and describe the advantages each provides.
- i. Determine the impact of changes (domain, constraints) in the structure of a relational database schema
- j. Study integrity and security
- k. Understand concepts of transactions
- l. Understand concurrency control
- m. Understand recovery system
- n. Study Distributed database
- o. Study advanced data mining and information retrieval
- p. Study MS SQL paradigm, and Oracle Paradigm

## 3. Synthesis and Evaluation

- a. Create a relational database schema in a RDBMS using SQL.
- b. Construct relation schemas and instances for a particular problem.
- c. Convert Relational Algebra expressions to SQL and vice versa.
- d. Design a relational database schema from a problem statement through conceptual/logical/physical database design.
- e. Write SQL expressions to perform operations (modify data or structure) on a relational database schema.
- f. Create an ER Model from the mission statement and objectives for a database application and change it given changes to requirements.
- g. Derive relations from an ER Model.
- h. Identify functional dependencies on relations and normalize database relations using the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> normal forms.
- i. Create physical database tables for a set of normalized relations.
- j. Complete a class project in three stages: (1) ER and relational designs for a problem. Normalize the relational design. (2) Design a three-tiered: browser/interface, Web server, DB server + application server. (3) Using MySQL and PHP to implement the system.

## LEARNING OBJECTIVES FOR CORE CURRICULUM REQUIREMENTS

This course is not a part of the University Core Curriculum.

## GRADING POLICIES

There will be two half-class length midterm exams, plus a three-hour final exam. Course grades will be assigned in consistency with the following weighting formula: attendance 5%, midterm one 12.5%, midterm two 12.5%, homework 15%, project 25%, final 30%.

A=90 or higher, B=80~89, C=70~79, D=60~69, F=0~59

Note: Bonus projects will be announced during the semester.

### Assignment Policies

- All assignments must be submitted to BlackBoard on or before the due date which will be specified on each assignment. Late assignments will be accepted up to one week with a onetime 20% late penalty.
- Assignments will be graded on the basis of correctness, quality of design, documentation, and style.
- Any assignment submitted without documentation will automatically receive a 20% deduction. Documentation, design, and style guidelines will be discussed as the semester progresses. No programming assignment will be graded which contains syntax errors.

### Homework Grading Criteria

1. If submission is within one week past the deadline, your grade will have 20% penalty reduction. That is, your work is first graded on 100% scale to receive a mark, say X, then the final mark Y is adjusted to  $Y = 80\% * X$ .
2. No submission one week past the deadline is accepted.
3. If your submitted program cannot be compiled or built, you get 0.
4. If your program has 70% or above similarity as detected by SafeAssign or grader, you get 0.
5. Now assume that your submission passes above 4 criteria.
  - 5.1. If your program passes compiling and building, the grader can give you 40% to 50% of the credit, depending on his evaluation.
  - 5.2. If your program passes 5.1, but cannot produce any desired outcomes, the grader can give you 50% to 60% of the credit, depending on his evaluation.
  - 5.3. If your program passes 5.1 and can produce partial desired outcomes, the grader can give you 60% to 100% of the credit, depending on his evaluation. For example, if the assignment asks for three outcomes with respect to three testing scenarios, the grader can allocate some percentage for each of the three outcomes, or consider some outcomes are more substantial and use them to judge whether you shall receive full credit.
  - 5.4. If your program passes 5.1 and can produce the desired outcomes as required by the assignment, you get 100% of the credit.
6. About proper formatting and documentation: The grader can take 5% to 10% off your program, if he thinks that this is necessary.

## TEXTBOOK AND/OR RESOURCE MATERIAL

The course textbook is *Database System Concepts*, by Silberschatz, Korth and Sudarshan, 6th edition, ISBN-13: 978-0073523323, ISBN-10: 0073523321, copyright © 2011 by the McGraw-Hill Companies, Inc. Not an open education resource. eTextbook price \$52.5 to \$82.49.

We will follow it rather closely, with additional topics in certain areas. A resource page ([click here](#)) for this textbook is maintained by the text authors.

## Topics and Schedule

Lecture	Date	Topic / Activity	Reading	Homework and handout
1	01/15	Introduction; Policy explanation; Relational DB	Chapter 1 & 2	Project Assignments: <a href="#">Part A</a> , <a href="#">Part B</a> , <a href="#">Part C</a> , <a href="#">Part D</a> .
2	01/22	Relational DB	Chapter 2	<a href="#">Chapter 1 ppt</a> <a href="#">Chapter 2 ppt</a> <a href="#">Chapter 3 ppt</a> <a href="#">Chapter 4 ppt</a> <a href="#">Chapter 5 ppt</a>
3	01/29	SQL	Chapter 3 & 4	Materials prepared by our TAs 1. How to create a DB in MySQL server 2. How to Program PHP through MySQL
4	02/5	SQL & Other Relational Languages	Chapter 4 & 5	HW 2
5	02/12	(1) MySQL Server (2) PHP server-side scripting (3) PHP DB access (4) Client side scripting and GUI design Reviews for Midterm 1	handouts	<a href="#">Chapter 6 ppt</a> <a href="#">Chapter 7 ppt</a> <a href="#">Chapter 8 ppt</a> <a href="#">Chapter 9 ppt</a> <a href="#">Chapter 10 ppt</a>
6	02/19	Lab Instruction: Coding Case study	handouts	Midterm 1.
7	02/26	DB Design & ER-model	Chapter 6	TDB: Sample solutions to Midterm 1.
8	03/5	Relational DB Design	Chapter 7	<a href="#">Chapter 11 ppt</a> <a href="#">Chapter 12 ppt</a> <a href="#">Chapter 13 ppt</a>
9	03/19	Application Design and Development	Chapter 8	<a href="#">Chapter 14 ppt</a> <a href="#">Chapter 15 ppt</a> <a href="#">Chapter 16 ppt</a>
10	03/26	Indexing and Hashing	Chapter 12	<a href="#">Chapter 17 ppt</a> <a href="#">Chapter 18 ppt</a> <a href="#">Chapter 19 ppt</a> <a href="#">Chapter 20 ppt</a> <a href="#">Chapter 21 ppt</a> <a href="#">Chapter 22 ppt</a>
11	04/2	Querying processing and Optimization	Chapter 13 & 14	Midterm 2. HW3
12	04/9	Transactions	Chapter 15	TDB: Sample solutions to Midterm 2.
13	04/16	Concurrency Control & Recovery System	Chapters 16, 17	HW4
14	04/25	(1) Data Mining	Chapters 18	HW5
15	04/28	(2) Information Retrieval	Chapter 19	
15	4/29- 5/2	Project Testing		
19	05/07	Final Exam		Final Exam TBD: Sample solutions to Final Exam

**Additional Topics in the following areas will be covered, if time permits**

1. Indexing techniques
2. Data Mining
3. Disk management techniques
4. Object-oriented DBs
5. Query optimization

## Other Course Information

Please visit my web page and BlackBoard regularly for additional course information and materials.

## CALENDAR OF ACTIVITIES

Be sure to include important dates relative to the academic calendar. The UTRGV academic calendar can be found at <https://my.utrgv.edu/home> at the bottom of the screen, *prior to login*. Some important dates for Spring 2020 include:

January 13	First day of classes
January 16	Last day to add a course or register for Spring 2020
January 20	Martin Luther King Jr. Holiday – NO classes
March 9-14	Spring Break – NO classes
April 9	Last day to drop a course; will count toward the 6-drop rule
April 10-11	Easter Holiday – NO classes
April 30	Study Day – NO classes
May 1-7	Final Exams
May 7	Spring classes end; Official last day of the term
May 8-9	Commencement Exercises

## OTHER COURSE INFORMATION

In this section, please provide any other information that is pertinent to your course and your expectations for students.

### UTRGV POLICY STATEMENTS

The UTRGV disability accommodation, mandatory course evaluation statement and sexual misconduct statement are required on all syllabi. Additional policy statements are optional, such as those covering attendance, academic integrity, and course drop policies.

### STUDENTS WITH DISABILITIES: Required on all syllabi. Do not modify.

Students with a documented disability (physical, psychological, learning, or other disability which affects academic performance) who would like to receive academic accommodations should contact **Student Accessibility Services (SAS)** for additional information. In order for accommodation requests to be considered for approval, the student is responsible for providing sufficient documentation of the disability to SAS and participating in an interactive discussion with SAS staff. Accommodations may be requested at any time but are not retroactive. Please contact SAS early in the semester/module for guidance. Students who experience a broken bone, severe injury, or undergo surgery may also be eligible for temporary accommodations.

### Pregnancy, Pregnancy-related, and Parenting Accommodations

Title IX of the Education Amendments of 1972 prohibits sex discrimination, which includes discrimination based on pregnancy, marital status, or parental status. Students seeking accommodations related to pregnancy, pregnancy-related condition, or parenting (reasonably immediate postpartum period) are encouraged to contact Student Accessibility Services for additional information and to request accommodations.

### Student Accessibility Services:

**Brownsville Campus:** Student Accessibility Services is located in 1.107 in the Music and Learning Center building (BMSLC) and can be contacted by phone at (956) 882-7374 or via email at [ability@utrgv.edu](mailto:ability@utrgv.edu).

**Edinburg Campus:** Student Accessibility Services is located in 108 University Center (EUCTR) and can be contacted by phone at (956) 665-7005 or via email at [ability@utrgv.edu](mailto:ability@utrgv.edu).

### MANDATORY COURSE EVALUATION PERIOD: Required on all syllabi. Do not modify.

Students are required to complete an ONLINE evaluation of this course, accessed through your UTRGV account (<http://my.utrgv.edu>); you will be contacted through email with further instructions. Students who complete their evaluations will have priority access to their grades. Online evaluations will be available on or about:

Module 1                      Feb 19-25, 2020

**ATTENDANCE:** Recommended on all syllabi; may be modified by the instructor as long as it is not inconsistent with UTRGV policy.

Students are expected to attend all scheduled classes and may be dropped from the course for excessive absences. UTRGV's attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service. Students should contact the instructor in advance of the excused absence and arrange to make up missed work or examinations.

**SCHOLASTIC DISHONESTY:** Recommended on all syllabi.

As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism (including self-plagiarism), and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations, STU 02-100, and UTRGV Academic Integrity Guidelines). **All scholastic dishonesty incidents will be reported to Student Rights and Responsibilities.**

**SEXUAL MISCONDUCT and MANDATORY REPORTING:** Required on all syllabi. Do not modify.

In accordance with UT System regulations, your instructor is a "Responsible Employee" for reporting purposes under Title IX regulations and so must report to the Office of Institutional Equity & Diversity ([oiie@utrgv.edu](mailto:oiie@utrgv.edu)) any instance, occurring during a student's time in college, of sexual misconduct, which includes sexual assault, stalking, dating violence, domestic violence, and sexual harassment, about which she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at [www.utrgv.edu/equity](http://www.utrgv.edu/equity), including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect that is free from sexual misconduct, discrimination, and all forms of violence. If students, faculty, or staff would like confidential assistance, or have questions, they can contact OVAVP (Office for Victim Advocacy & Violence Prevention) at (956) 665-8287, (956) 882-8282, or [OVAVP@utrgv.edu](mailto:OVAVP@utrgv.edu).

**COURSE DROPS:** Recommended on all syllabi; may be modified by the instructor as long as it is not inconsistent with UTRGV policy.

According to UTRGV policy, students may drop any class without penalty earning a grade of DR until the official drop date. Following that date, students must be assigned a letter grade and can no longer drop the class. Students considering dropping the class should be aware of the "3-peat rule" and the "6-drop" rule so they can recognize how dropped classes may affect their academic success. The 6-drop rule refers to Texas law that dictates that undergraduate students may not drop more than six courses during their undergraduate career. Courses dropped at other Texas public higher education institutions will count toward the six-course drop limit. The 3-peat rule refers to additional fees charged to students who take the same class for the third time.

**STUDENT SERVICES:** Recommended on all syllabi.

Students who demonstrate financial need have a variety of options when it comes to paying for college costs, such as scholarships, grants, loans and work-study. Students should visit the Students Services Center (U Central) for additional information. U Central is located in BMAIN 1.100 (Brownsville) or ESSBL 1.145 (Edinburg) or can be reached by email ([ucentral@utrgv.edu](mailto:ucentral@utrgv.edu)) or telephone: (888) 882-4026. In addition to financial aid, U Central can assist students with registration and admissions.

Students seeking academic help in their studies can use university resources in addition to an instructor's office hours. University Resources include the Advising Center, Career Center, Counseling Center, Learning Center, and Writing Center. The centers provide services such as tutoring, writing help, counseling services, critical thinking, study skills, degree planning, and student employment. In addition, services such as the Food Pantry are also provided. Locations are listed below.

Center Name	Brownsville Campus	Edinburg Campus
<b>Advising Center</b> <a href="mailto:AcademicAdvising@utrgv.edu">AcademicAdvising@utrgv.edu</a>	BMAIN 1.400 (956) 665-7120	ESWKH 101 (956) 665-7120
<b>Career Center</b> <a href="mailto:CareerCenter@utrgv.edu">CareerCenter@utrgv.edu</a>	BCRTZ 129 (956) 882-5627	ESSBL 2.101 (956) 665-2243
<b>Counseling Center</b> <a href="mailto:Counseling@utrgv.edu">Counseling@utrgv.edu</a> <a href="#">Counseling and Related Services List</a>	BSTUN 2.10 (956) 882-3897	EUCTR 109 (956) 665-2574
<b>Food Pantry</b> <a href="mailto:FoodPantry@utrgv.edu">FoodPantry@utrgv.edu</a>	BCAVL 101 & 102 (956) 882-7126	EUCTR 114 (956) 665-3663
<b>Learning Center</b> <a href="mailto:LearningCenter@utrgv.edu">LearningCenter@utrgv.edu</a>	BMSLC 2.118 (956) 882-8208	ELCTR 100 (956) 665-2585
<b>Writing Center</b> <a href="mailto:WC@utrgv.edu">WC@utrgv.edu</a>	BUBLB 3.206 (956) 882-7065	ESTAC 3.119 (956) 665-2538