Course Syllabus

Welcome!

Welcome to the database class (ISM 6218). Data science is an exciting area and major theme of our graduate programs. This is clearly a multi-disciplinary field, but effective data management is certainly a core skill. While this course does focus on the widely used relational model, alternative technologies that rely on distributed processing approaches balance the coverage. The course is laid out as a series of distinct core modules, typically one per week (a couple if they are small). These core modules include textbook readings, assignments and online quizzes. Special topics are used to cover additional material and/or emerging technologies.

This course includes significant hands-on experience, so you will apply what you learn. The discussions and assignments will also reinforce important competencies such as creative thinking, teamwork and digital skills (see the nationally-standardized career readiness competencies at **http://www.naceweb.org/career-readiness/competencies/career-readiness-defined/ (http://www.naceweb.org/career-readiness/competencies/career-readiness-defined/)** for details).

University Course Description

This course covers core business database technologies. Topics include database design, transaction processing, parallelism, and distributed databases. Emerging business intelligence technologies are covered. A database system is used for projects.

You can find the official description at **http://ugs.usf.edu/course-inventory/ (http://ugs.usf.edu/course-inventory/)** .

Course Prerequisites

There are no official prerequisites. However, there is an assumption that you have taken a database course prior to admission in our program (or have significant professional experience).

Course Purpose

This course is designed for the MS graduate student and interested MBA students. The overall course objectives are to provide a sound database system foundation, while highlighting additional special topics and applications. To meet these objectives in a single course, introductory topics are combined with a selection of more advanced topics. For example, fundamental relational database topics are reviewed, including query writing and database design. In addition, more advanced topics, such as indexing, query processing, and parallelism look at database performance issues typically covered in a second semester course. These topics taken together provide a foundation for effective database use.

Students will develop applied skills such as query writing using the Structured Query Language (SQL), database design and Entity-Relationship Diagrams (ERDs), along with query performance tuning by looking indexing and query optimization. Special topics that complement the core modules provide coverage of emerging high-impact technologies, such as NoSQL databases and cloud computing. The

final modules will introduce data warehousing and data mining techniques, which are covered more thoroughly in subsequent elective courses.

The class focuses on a combination of theory and practical database use, which will be illustrated primarily through the Oracle DBMS software. The Oracle database engine is freely available for educational use from Oracle Corporation. Therefore, students will have access to many of the sophisticated tools at home and on mobile platforms. In addition, access to local database servers will be provided, so all hands-on projects can be pursued in an industrial quality environment. Though the primary database engine will be the Oracle DBMS, coverage of Microsoft SQL Server will be included to highlight common features, as well as alternative approaches.

How to Succeed in this Course

First, please visit Canvas often and monitor all course announcements. Canvas will be the primary means of communicating, as well as organizing and presenting the course content. For each week, review the most important material identified in “Start Here” pages. Our in-class time is designed to further and deepen the knowledge, concepts, and skills from the readings – not just repeat the information. We will also use hands-on laboratory activities to reinforce and apply skills. USF also suggests many study tips, so have a look at the resources below.

Study skills of successful students: This one-page handout details what the study skills behaviors of top students look like: **http://bit.ly/successfulstudentbehaviors (http://bit.ly/successfulstudentbehaviors)** . This 18-page PDF provides 101 individual tips for effective study skills and note-taking: **http://bit.ly/studyskillstips (http://bit.ly/studyskillstips)**

Best practices for hybrid courses: Successful students should follow these tips to succeed in classes where they switch between remote and in-person attendance: **https://www.usf.edu/atle/documents/student-best-practices-hybrid.pdf (https://www.usf.edu/atle/documents/student-best-practices-hybrid.pdf)**

Canvas: See the Community Guides at **https://community.canvaslms.com/t5/Student/gh-p/student (https://community.canvaslms.com/t5/Student/gh-p/student)** .

Micrsoft Teams: See best the practices video for Teams at **https://youtu.be/q6zqaSMtnjg (https://youtu.be/q6zqaSMtnjg)**

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. For some written guides, see the student introduction (**https://www.usf.edu/atle/documents/student-guide-microsoft-teams.pdf (https://www.usf.edu/atle/documents/student-guide-microsoft-teams.pdf)**) and etiquette (**http://www.usf.edu/atle/documents/teams-etiquette.pdf (http://www.usf.edu/atle/documents/teams-etiquette.pdf)**) documents.

Course Topics

Part I - Structured Query Language (SQL): The course starts with hands-on query writing as a core skill (and to foster student engagement), along with a look at the relational database model.

Part II - Database Modeling and Design Review: Brief coverage of database modeling and design issues is intended as a review before the preliminary group project design is due.

Part III - Database Architecture: The Oracle DBMS will be used as a hands-on example of a relational DBMS to illustrate the theoretical topics, as well as to implement the semester project. The first few classes will be used to cover specific aspects of the DBMS engine (from a DBA-like perspective), with the goal of establishing a foundation for the remainder of the course.

Part IV – Advanced Relational DBMS Technologies: This part of the course surveys key database technologies such as storage subsystems, query optimization, transaction processing, concurrency control, and other topics. Again, the Oracle DBMS will be used to illustrate the material.

Part V – Alternative Database Models: Important topics such as high availability databases, distributed databases, and parallel databases demonstrate the techniques necessary for enterprise-level data infrastructures.

Part VI – Special Topics: A selection of special topics such as object-oriented databases, data warehousing, and data mining will be covered as time permits.

Student Learning Outcomes

By the end of this course, students will be able to:

1. Describe the widely used relational database model.
2. Write queries using SQL.
3. Design and document database systems using entity-relationship diagram (ERD) tools.
4. Implement database systems using SQL data definition statements and integrity constraints.
5. Apply various techniques such as index structures and optimization modes to improve query performance.
6. Contrast a variety of alternative (NoSQL) database models with the relational model with regards to workload fit.

Required Texts and/or Readings and Course Materials

Recommended textbook: A Silberschatz, HF Korth and S Sudarshan, *Database Systems Concepts*, Seventh Edition, McGraw-Hill, 2010, ISBN 9780078022159. The authors also maintain a website with a lot of helpful material: **https://www.db-book.com (https://www.db-book.com/)** . This book is recommended, not strictly required. The course uses this edition, but you can get by with a slightly older edition (or even another good technical database book) to reduce costs. In addition to the textbook, there is a wealth of online documentation and other readings that are included within the modules. See the course resources page, as well as specific links within modules.

For hands-on activities, we will use the Oracle RDBMS and several existing example databases. However, coverage of other relational systems such as Microsoft SQL Server and alternative NoSQL technologies is included throughout.

Supplementary (Optional) Texts and Materials

Oracle maintains an extensive library of online documentation that students will find useful during the course (see **https://docs.oracle.com/en/database/oracle/oracle-database/ (https://docs.oracle.com/en/database/oracle/oracle-database/)**).

Grading Scale

Grade Range	Letter Grade
94-100	A
90-93	A-
87-89	B+
84-86	B
80-83	B-
77-79	C+
74-76	C
70-73	C-
67-69	D+
64-66	D
60-63	D-
0-59	F

Grade Categories and Weights

The course relies on three types of assessments: 1) online quizzes (as self-paced checks on core modules), 2) group assignments that apply skills and 3) a final project that requires some creative thinking and the synthesis of skills. These activities are weighted as show below.

Assessment	Percent of Final Grade
Online Quizzes (8)	40%
Assignments (Group) (4)	40%
Final Project (Group)	20%
Participation and Attendance	5%

Course Assessments

There are three categories of assignments or activities used for assessment.

1. **Online quizzes** (8) are part of all core modules (after the introductory module), accounting for **40%** of the grade.

2. Assignments (4) are given in selected modules, with roughly two weeks to complete (for a total of **40%** of the grade). The first two assignments on query writing and database design are structured. The following two assignments are in the style of "experiments of the week" with students designing experiments that explore the relevant topics (some suggested ideas are provided). These assignments are intended to be group Note: For shorter versions of the course (6-8 weeks), one assignment may be dropped.
3. The **final project** (**15%**) gives you an opportunity to design a database for yourself in whatever area interests you. You can re-visit and improve experiments from prior module assignments as well. You can pursue a completely new database or build on some of the case studies (like the university database, relational movie database or milestone market). Just make that clear in the final project plan. Again, this project should synthesize material from prior assignments, providing an opportunity to incorporate any feedback and expand the coverage of critical topics. *Make sure to include an executive summary highlighting the topics covered and any improvements or extensions to prior material.*
4. Class **participation** (**5%**) will be based on contributions in class, discussion boards and/or other collaborative **meetings**. This will along with peer assessments from group members will be used to reward highly engaged participants.

Group assignments and the final project are to be completed by a small group (approximately 3-5 people) and involve the design and implementation of database experiments, as well as query writing, design, and even database administration activities. The application areas may extend one of the example databases design used in class or based on a work-related project (with prior approval).

Grade Dissemination

The Canvas system will be used throughout the course. Students can access scores and other information at any time using “Grades” in Canvas.

Course Schedule

This is a tentative course schedule for a 12-week format. Of course, adjustments would be made based on course duration such an 8-week format. See the course **Modules (https://usflearn.instructure.com/courses/1810302/modules)** for a detailed schedule.

Week	Module	Assignment
1/12	Module 1: Relational Databases	NA
2/12	Module 2: Structured Query Language (SQL) Special Topic: Recommender Systems	Quiz 1: SQL Assignment 1: Query Writing
3/12	Module 3: Database Design Special Topic: Database Programming	Quiz 2: Database Design Assignment 2: Database Design

4/12	Module 4: DBMS Architecture	Quiz 2: Database Design Assignment 2: Database Design
5/12	Module 5: Indexing and Hashing	Quiz 4: Indexing Assignment 3: Tuning EotW1
6/12	Module 6: Query Processing	Quiz 5: Query Processing
7/12	Module 7: Transaction Processing	Quiz 6: Transaction Processing Assignment 4: Tuning EotW2
8/12	Module 8: Parallel Databases	Quiz 7: Parallel Databases
9/12	Special Topic: Database Security	NA
10/12	Module 9: Distributed Databases	Quiz 8: Distributed Databases Final Project
11/12	Special Topic: NoSQL Databases	NA
12/12	Special Topic: Data Warehousing and Mining	NA

Standard University Policies

Policies about disability access, religious observances, academic grievances, academic integrity and misconduct, academic continuity, food insecurity, and sexual harassment are governed by a central set of policies that apply to all classes at USF. These may be accessed at: **https://www.usf.edu/provost/faculty/core-syllabus-policy-statements.aspx (https://www.usf.edu/provost/faculty/core-syllabus-policy-statements.aspx)** .

Covid-19 Procedures

All students must comply with university policies and posted signs regarding COVID-19 mitigation measures, including wearing face coverings and maintaining social distancing during in-person classes. Failure to do so may result in dismissal from class, referral to the Office of Student Conduct and Ethical Development, and possible removal from campus.

Additional details are available on the University's Core Syllabus Policy Statements page: **https://www.usf.edu/provost/faculty/core-syllabus-policy-statements.aspx (https://www.usf.edu/provost/faculty/core-syllabus-policy-statements.aspx)** .

Course Policies

Late Work Policy: Graduate students may be balancing work demands with their studies. Extensions may be possible on a per-assignment basis in advance of a due date. Unexcused late assignments will be

assessed a penalty: a half-letter grade if it is 1-2 days late, or a full-letter grade for 3-7 days late. Assignments will not be accepted if overdue by more than seven days.

Grades of "Incomplete": Grades of incomplete are to be avoided if at all possible (especially at the graduate level). Any students that are at risk of not completing the course should reach out to the instructor as soon as possible. The preferred approach is to turn in most of the assignments even in draft form and receive a final grade, which can be adjusted later once the final versions of any missing assignments are submitted. The formal university policies governing an “I” grade are as follows.

For undergraduate courses: An “I” grade may be awarded to a student only when a small portion of the student’s work is incomplete and only when the student is otherwise earning a passing grade. The time limit for removing the “I” is to be set by the instructor of the course. For undergraduate students, this time limit may not exceed two academic semesters, whether or not the student is in residence, and/or graduation, whichever comes first. For graduate students, this time limit may not exceed one academic semester. “I” grades not removed by the end of the time limit will be changed to “IF” or “IU,” whichever is appropriate.

For graduate courses: An Incomplete grade ("I") is exceptional and granted at the instructor’s discretion only when students are unable to complete course requirements due to illness or other circumstances beyond their control. The course instructor and student must complete and sign the "I" Grade Contract Form that describes the work to be completed, the date it is due, and the grade the student would earn factoring in a zero for all incomplete assignments. The due date can be negotiated and extended by student/instructor as long as it does not exceed two semesters for undergraduate courses and one semester for graduate courses from the original date grades were due for that course. An "I" grade not cleared within the two semesters for undergraduate courses and one semester for graduate courses (including summer semester) will revert to the grade noted on the contract.

Group Work Policy: Everyone must take part in a group project. All members of a group will receive the same score; that is, the project is assessed, and everyone receives this score. In addition, However, every person in the group will provide the instructor with a peer assessment at the end of the semester. The instructor will adjust the total assignment grade based on peer suggestions (by up to 10%).

Email: The Canvas Inbox is the preferred method of communication, but you may use official USF email as a second method (see the email address above). The goal is to respond within 1-2 days to any request.

Canvas: This course will be offered via USF's learning management system (LMS), Canvas. The Canvas Inbox feature is the preferred method of communication. If you need help learning how to perform various tasks related to this course or other courses being offered in Canvas, please view the following videos or consult the Canvas help guides. You may also contact USF's IT department at (813) 974-1222 or **help@usf.edu (mailto:help@usf.edu)** .

Student Expectations

Attendance Policy: Students are expected to attend classes. Faculty must inform students of attendance requirements on syllabi. Instructors should accommodate excused absences by making arrangements with students ahead of time (when possible) or by providing a reasonable amount of time to make up missed work.

Course Hero / Chegg Policy: The **USF Policy on Academic Integrity (http://regulationspolicies.usf.edu/regulations/pdfs/regulation-usf3.027.pdf)** specifies that students may not use websites that enable cheating, such as by uploading or downloading material for this purpose. This does apply specifically to Chegg.com and CourseHero.com – any use of these websites (including uploading proprietary materials) constitutes a violation of the academic integrity policy.

Professionalism Policy: Per university policy and classroom etiquette; mobile phones, iPods, etc. **must be silenced** during all classroom and lab lectures. Those not heeding this rule will be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade.

End of Semester Student Evaluations: All classes at USF make use of an online system for students to provide feedback to the University regarding the course. These surveys will be made available at the end of the semester, and the University will notify you by email when the response window opens. Your participation is highly encouraged and valued.

Food and Drink Policy: Please adhere to the firm policy of no beverages (other than bottled/capped water), food, tobacco products, or like items in the classroom. Your understanding of the necessity for this policy and cooperation will be greatly appreciated. This policy will be strictly enforced.

Turnitin.com: In this course, turnitin.com may be utilized. Turnitin is an automated system which instructors may use to quickly and easily compare each student's assignment with billions of web sites, as well as an enormous database of student papers that grows with each submission. After the assignment is processed, as instructor I receive a report from turnitin.com that states if and how another author's work was used in the assignment. For a more detailed look at this process visit **http://www.turnitin.com (http://www.turnitin.com)** .

Learning Support and Campus Offices

Tampa Campus

Tutoring Hub

Example: The Tutoring Hub offers free tutoring in **several subjects (https://www.usf.edu/undergrad/academic-success-center/tutoring/courses-tutored.aspx)** to USF undergraduates. Appointments are recommended, but not required. For more information, email **asctampa@usf.edu (mailto:asctampa@usf.edu)**

Writing Studio

Example: The Writing Studio is a free resource for USF undergraduate and graduate students. At the Writing Studio, a trained writing consultant will work individually with you, at any point in the writing process from brainstorming to editing. Appointments are recommended, but not required. For more information or to make an appointment, email **writingstudio@usf.edu (mailto:writingstudio@usf.edu)**

Counseling Center

Example: The Counseling Center promotes the wellbeing of the campus community by providing culturally sensitive counseling, consultation, prevention, and training that enhances student academic and personal

success. Contact information is available **online (https://www.usf.edu/student-affairs/counseling-center/about-us/contact-us.aspx)** .

Center for Victim Advocacy

Example: The Center for Victim Advocacy empowers survivors of crime, violence, or abuse by promoting the restoration of decision making, by advocating for their rights, and by offering support and resources. Contact information is available **online (https://www.usf.edu/student-affairs/victim-advocacy/contact-us/index.aspx)** .

St. Petersburg Campus

Student Success Center

Example: The Student Success Center provides free tutoring and writing consultations. Contact information is available **online (https://www.stpetersburg.usf.edu/student-life/student-success-center/about/index.aspx)** .

Wellness Center

Example: The Wellness Center provides counseling and medical services, as well as prevention programs and victim advocacy. Contact information is available **online (https://www.stpetersburg.usf.edu/student-life/wellness/about/schedule-appointment.aspx)** .

Sarasota-Manatee Campus

Tutoring and Writing Support

Example: Learning Support Services provides free tutoring and writing consultations for a variety of courses and subjects such as, Accounting, Biology, Chemistry, Finance, Math & Statistics, Physics, and Spanish. Make an appointment **online (https://www.sarasotamanatee.usf.edu/academics/academic-resources/information-commons/tutoring.aspx)** .

Counseling and Wellness Center

Example: The Counseling and Wellness Center is a confidential resource where you can talk about incidents of discrimination and harassment, including sexual harassment, gender-based crimes, sexual assault, stalking, and domestic/relationship violence. Call 941-487-4254

Victim Advocate

Example: A Victim Advocate is available 24/7 by calling (941) 504-8599. For assistance leave a message with your phone number and your call will be returned as soon as possible. The Victim Advocate is available to assist victims of crime, sexual assault, and partner violence.

Important Dates to Remember

All the dates and assignments are tentative and can be changed at the discretion of the professor. To confirm these dates, please see the official USF calendar maintained by the Registrar (see **https://www.usf.edu/registrar/calendars/ (https://www.usf.edu/registrar/calendars/)**).

Drop/Add Deadline: Fri, Aug 28, 2020

Labor Day Holiday: Mon, Sept 7, 2020

Mid-term Grading Opens: Mon, Oct 5, 2020

Mid-term Grading Closes: Fri, Oct 16, 2020

Withdrawal Deadline: Sat, Oct 31, 2020

Veteran's Day Holiday: Wed, Nov 11, 2020

Last Day on Campus: Wed, Nov 25, 2020

Thanksgiving Holiday: Thurs, Nov 26 & Fri, Nov 27, 2020

Classes Online Only: Mon, Nov 30, 2020 - Fri, Dec 4, 2020

Final Examination Week: Sat, Dec 5 - Thurs, Dec 10, 2020

Course Summary:

Date	Details	Due
Fri Oct 20, 2023	First-Day Attendance (https://usflearn.instructure.com/courses/1810302/assignments/14980785)	due by 11:59pm
Sun Nov 5, 2023	M2-SQL Quiz: SQL (https://usflearn.instructure.com/courses/1810302/assignments/14980775)	due by 11:59pm
	SQL Practice Test (SQLMDB) (https://usflearn.instructure.com/courses/1810302/assignments/14980765)	due by 11:59pm
Thu Nov 9, 2023	SQL Test (SQLMDB) - Take 1 (https://usflearn.instructure.com/courses/1810302/assignments/14980769)	due by 11:59pm
Sun Nov 12, 2023	M3-DES Quiz: Database Design (https://usflearn.instructure.com/courses/1810302/assignments/14980761)	due by 11:59pm
Tue Nov 14, 2023	SQL Test (SQLMDB) - Take 2 (https://usflearn.instructure.com/courses/1810302/assignments/14980753)	due by 11:59pm
Sat Nov 18, 2023	DB Design Test - Take 1 (https://usflearn.instructure.com/courses/1810302/assignments/14980767)	due by 11:59pm
Sun Nov 19, 2023	DB Design Practice Test (https://usflearn.instructure.com/courses/1810302/assignments/14980755)	due by 11:59pm
	M4-ARC Quiz: DBMS Architecture (https://usflearn.instructure.com/courses/1810302/assignments/14980751)	due by 11:59pm

Date	Details	Due
	Project Plan (https://usflearn.instructure.com/courses/1810302/assignments/14980793)	due by 11:59pm
Fri Nov 24, 2023	DB Design Test - Take 2 (https://usflearn.instructure.com/courses/1810302/assignments/14980749)	due by 11:59pm
Sun Nov 26, 2023	M5-IDX Quiz: Indexing (https://usflearn.instructure.com/courses/1810302/assignments/14980763)	due by 11:59pm
Sun Dec 3, 2023	M6-QRY Quiz: Query Processing (https://usflearn.instructure.com/courses/1810302/assignments/14980759)	due by 11:59pm
	M7-TXN Quiz: Transaction Processing (https://usflearn.instructure.com/courses/1810302/assignments/14980757)	due by 11:59pm
	Performance Tuning (PT) 1 Assignment (https://usflearn.instructure.com/courses/1810302/assignments/14980789)	due by 11:59pm
Fri Dec 8, 2023	M8-PAR Quiz: Parallel Databases (https://usflearn.instructure.com/courses/1810302/assignments/14980771)	due by 11:59pm
	M9-DDB Quiz: Distributed Databases (https://usflearn.instructure.com/courses/1810302/assignments/14980773)	due by 11:59pm
	Final Project (https://usflearn.instructure.com/courses/1810302/assignments/14980783)	due by 11:59pm
	Peer Assessment (https://usflearn.instructure.com/courses/1810302/assignments/14980787)	due by 11:59pm