# IST659: Syracuse University Graduate Course Syllabus

## Course Title

IST659: Data Administration Concepts and Database Management

## Course Information

### Meeting Times

| Section | Day | Time | Location |
| --- | --- | --- | --- |
| TBD | TBD | TBD | TBD |

### Instructor

| Key | Value |
| --- | --- |
| **Name** | Your Name |
| **Title** | Your Title |
| **Office** | Your Office |
| **Email** | Your Email |
| **Office Hours** | Your Office Hours |

### Course Description

Definition, development, and management of databases for information systems. Data analysis techniques, data modeling, and schema design. Query languages and search specifications. Overview of file organization for databases. Data administration concepts and skills.

### Additional Course Description

This is an introductory course in database management systems. It examines data structures, file organizations, concepts, and principles of database management systems(DBMS); as well as, data analysis, database design, data modeling, database management and database implementation. There is a specific emphasis on data analytics and learning to query data with Structured Query Language (SQL), query performance, data normalization; and database migration. This course provides hands-on experience in database design and implementation through assignments, lab exercises and course projects. This course also introduces advanced database concepts such as transaction management and concurrency control, distributed databases, multi-tier client/server architectures, database applications, improving query performance through indexing, and advanced data query patterns for extract-transform-load.

### Prerequisite / Co-requisite:

None

### Audience:

This is an introductory course and requires no prior knowledge in the subject area.

### Credits:

3

### Learning Objectives

Upon completing this course, the learner should be able to:  
- Describe fundamental data and database concepts including various storage models.  
- Explain and use the database development lifecycle and data models.  
- Analyze business problems and design and implement appropriate data-oriented solutions using the relational data storage model.  
- Solve problems by constructing database objects and queries using the SQL language.  
- Identify performance and data integrity improvements of existing database designs and implementations.  
- Evaluate and select approaches for data migrations, temporal data, and data normalization.  
- Critique the effectiveness of DBMS in computer information systems.

### Course Fees and/or Costs

None

### Required Textbooks and Supplies

* **Applied Database Management**, By Michael Fudge. ISBN 9781644965900. The book is an online text available within Blackboard, and at https://www.grlcontent.com/. At your instructor’s discretion you may take quizzes through the textbook. The textbook is very closely aligned with the course content and and labs.
* Students are expected to have a laptop computer to participate in the class sessions, run the lab software, and complete the problem sets. Requirements are any Mac OSX, Windows 10, or Chromebook with 8GB RAM and 8GB free disk space.

### Understanding the Approach Used in This Course

I would like to spend time explaining the pedagogical approach used in this course. I am a big believer in the science behind distributed/spaced practice. Simply put, you will be a more effective learner if you are exposed to the subject matter several times over the week, rather than just once per week. As such, each lesson has three phases, which I recommend you distribute over 3 days each week, at minimum.

1. **Before Class Activities**. You will complete the coursework before class, as part of early-stage learning. This will expose you to the concepts of the unit, and hopefully get you asking questions about it. Your responsibilities:
   1. Read the assigned textbook chapter and complete the active learning activities therein,
   2. Watch the video lecture and complete the active learning activities, and
   3. As you consume the lesson, prepare questions pertinent to the course material.
   4. Complete the Quiz, a test of your conceptual understanding.
   5. Submit at least two questions you have about the coursework from 1.a to 1.d
2. **In-Class Activities.** Since the lecture was completed before class, in class we can focus on concept reinforcement, applying what was learned and discussion:
   1. There will be a brief participatory discussion of the previous unit's homework assignment 3.b as a means of wrapping up the unit.
   2. Your instructor will prepare class activities and examples specific to your questions posted in 1.d, and the outcomes of quiz 1.e
   3. There will be class activities which demonstrate your ability to apply the course material
3. **After Class.** Lab and Problem Set. After our In-class meeting, you are expected to complete:
   1. lab: a guided activity based on the week’s coursework, to apply concepts
   2. A problem set: homework problems where you must problem solve, analyze, evaluate and develop solutions to problems related to the week’s coursework.
   3. Summarize and reflect on what you have learned.

This system is very effective and once you get used to it. Spaced practice gives you time to reflect on your learning and refine your metacognition, which is essential to becoming an independent learner. I am certain you will discover this approach is a productive use of your time and maximizes your learning.

### Tools we may use in this Course

It is suggested that you install and configure these tools on your laptop before the course begins.

* **Zoom.** Zoom is a video conferencing tool we will use for our scheduled online and hybrid face to face sessions. Each session will be recorded and posted to Blackboard. Download the zoom client at <https://zoom.us>
* **Microsoft Teams.** Teams is collaboration tool. Integrating with email and calendaring Teams offers presence awareness and chat / messaging. These chats can be elevated into a video conference. We will use teams for out of class discussions, homework questions and possibly office hours. Your Office 365 account is linked to your NetID. Logon to teams by visiting <https://portal.office.com> entering your SU email [*netid@syr.edu*](mailto:netid@syr.edu) and then your NetID password. One you are signed into Office 365, click the Teams icon.
* **Google Docs**. We may use Google Docs as a collaborative note-taking tool to work in class on problems and breakout activities. Login with your SU Google account <https://g.syr.edu>.
* **Docker**. Docker is a containerization platform, allowing you to run applications in isolation from your host computer. In this course we use it to run the DBMS itself and their supporting tools. You can download and install docker by following the instructions here: <https://docs.docker.com/get-docker/>
* **Azure Data Studio**. Azure Data studio (ADS) is a SQL Database client. While you can get away with using the web tools provided with the learn-databases setup, the ADS experience is better. To install, follow the instructions here: <https://docs.microsoft.com/en-us/sql/azure-data-studio/download-azure-data-studio>
* **Learn Databases.** Learn Databases is a suite of docker containers which create a database lab environment on your computer. There are containers for the SQL Server database management system itself, and 3 web tools for provisioning sample databases, database administration and writing SQL scripts. After you have installed Docker, follow the instructions at <https://github.com/mafudge/learn-databases> to set it up. Do not create any sample databases at this time – you will do this as part of the first problem set.

### Special Considerations

#### Class Materials and Recordings

Please be aware that all class sessions may be recorded. Original class materials (handouts, code samples, assignments, quizzes, textbook chapters, etc.) and recordings of class sessions are the intellectual property of the course instructor and course designer. You may download these materials for your use in this class. However, you may not provide these materials to other parties (e.g., web sites, social media, other students) without permission. Doing so is a violation of intellectual property law and of the student code of conduct.

## Academic Expectations

### Requirements

As an enrolled student in this course, it is expected that you will:

1. **Participation and Engagement.** It is expected you will complete the assigned readings, and video coursework as prescribed, and be a willing and active participant in class.
   * Participation in the assigned reading and video coursework is required and will be measured through analytics tools provided by the LMS and the textbook.
   * Attendance is required and there are no excused absences other than medical illness documented by the university. You must be present to participate!
   * While in attendance you are expected to be engaged, an active participant in class. You should be prepared to ask and answer questions to the best of your ability when called upon.
   * In some classes an ungraded pop-quiz or other type of diagnostic instrument will measure your comprehension of coursework and passing will count as your participation grade for that week.
   * Reading and Video lectures must be completed by 11:59 PM Eastern time 1 day before our class meeting.
   * **Reading, participation and coursework are not graded but do impact your grade.**
     + **Unprepared for 2 units of the course: decrease your final grade by one Registrar Grade. (For example, A to A-)**
     + **For 4 or more units of the course: decrease your final grade one complete letter: B+ to C+ for example.**
     + **You will be notified when you reach these thresholds.**
2. **Complete Quizzes**. The intention of the quiz is to ensure you are keeping pace with the coursework and to measure your understanding of the class material. Quizzes are issued online through the blackboard LMS.
   * You will get one attempt at the quiz and your attempt must be complete before your class meeting.
   * Quizzes consist of multiple choice and/or short answer questions.
   * Quizzes individual effort.
   * You must complete the one date before our class meeting. There are no make ups.
3. **Complete Homework Problem Sets**. These problem sets are applied activities which enforce key concepts learned in the lesson through problem-solving and practice. You start them after our class session and **complete them by 11:59 PM Eastern one day before our next class meeting**. It is important to remember that the homework is practice, if you do not have the right correct, it is expected you will have questions. Solutions to the homework are provided so you can check your work and ask deeper questions. You are expected to reflect on your learning. Each Problem Set is assigned a grade of:
   * High Pass (10 points) the assignment is complete and correct with very minor errors, and student contributes to homework discussion in class and a reflection on your learning for that week.
   * Needs Improvement (5 points) the assignment is incomplete or there is little to no meaningful reflection on your learning for the week. The assignment is up to 1 week late.
   * Fail (0 points) the assignment was not turned in after 1 week.
4. Complete a **Team Project**, which demonstrates your ability to work in a team to design and implement a functional system with a database, based on what you have learned in the course. Guidelines:
   * Work in self-assembled teams of 2-3 students.
   * Devise your own database to design and implement. The project idea must be pre-approved prior to beginning work.

Required artifacts for submission

1. Document with team name, group members and which project you will work on. If the project is your own idea, a requirements document must be submitted and approved.
2. Data analysis of the facts listing entities, attributes, and relationships in the data model.
3. Conceptual Data Model Diagram.
4. Logical Data Model Diagram.
5. Identification of your external data model and data logic.
6. Basic layout of all application screens.
7. Diagram of each screen used in the application.
8. SQL Up/Down script to implement the internal model with initial data.
9. SQL Up/Down Script to load / migrate in existing data.
10. SQL Up/Down script of data logic for the external data model.
11. Implementation of the application itself.
12. A team log recording individual and group contributions to the project including when and by whom.
13. A slide deck of your presentation.
14. A Video recording of your team presentation.
15. A Video reflection of what you learned from the experience, what you would do better if you had the time, etc.

Rubric

1. Quality of artifacts (slides, code, video, docs, etc.)
2. Completeness of project – does it work?
3. Purpose of project – does it do something of value?
4. What was learned from the experience?
5. Does the project demonstrate what the team has learned pertinent to the course?

### Grading:

| **Type of Activity** | **Quantity** | **Points Each** | **Notes** | **Total Points** |
| --- | --- | --- | --- | --- |
| 1. Problem Sets | 12 | 10 | 13 Total. Lowest Dropped. | 120 |
| 2. Quizzes | 12 | 10 | 13 Total. Lowest dropped. | 120 |
| 3. Team Project | 1 | 60 | Refer to team project guideline. | 60 |
| **Total POints** |  |  |  | 300 |

### Grading Scale:

| **Student Achievement** | **Percentage** | **Grade Points** | **Registrar Grade** |
| --- | --- | --- | --- |
| Mastery | 285 - 300 | 4.0 | A |
|  | 270 - 284 | 3.667 | A - |
| Satisfactory | 255 - 269 | 3.333 | B + |
|  | 225 - 254 | 3.0 | B |
| Low Passing | 210 - 224 | 2.667 | B - |
|  | 195 - 209 | 2.333 | C + |
| Unsatisfactory | 180 - 194 | 2.0 | C |
|  | 165 - 179 | 1.667 | C - |
|  | 0 - 164 | 0 | F |

## Other Course Policies

* All work is due on the dates provided. No late work is accepted, unless explicitly noted. The reasoning is the grading is participation / effort-based and most of the content time-sensitive.
* Final grades will not be rounded up. 94/100 is an A-, please don’t ask.

### Academic Integrity

* We take academic integrity seriously, and so should you.
* It is our expectation that your work will be 100% representative of your academic abilities.
* Cheating, including assistance from others or use of non-sanctioned academic materials on quizzes or homework is prohibited.
* Do not work together unless the instructions state explicitly you are permitted to do so.
* When in doubt as to whether you can use a resource outside those provided in the course, **ask your instructor**.
* All violations of academic integrity will be reported to the AIO office. Proposed grade sanction is F in the course.

## Course Calendar

### Course Schedule

| **Week** | **Dates** | **Topic for That Week** | **What is Due?** |
| --- | --- | --- | --- |
| 1 |  | Unit 1 – Introduction to Databases *Data, information, metadata and data management* | Text Ch 1, Unit Quiz 1 |
| 2 |  | Unit 2 – The Relational Model *relational concepts in depth, keys, constraints, tables and relations.* | Problem Set 1, Text Ch 2, Unit Quiz 2 |
| 3 |  | Unit 3 – Introduction to SQL *DDL, DML, migration scripts* | Problem Set 2, Text Ch 3, Unit Quiz 3 |
| 4 |  | Unit 4 – SQL Select Part I *Projections, filters, joins, table / column aliases, case* | Problem Set 3, Text Ch 4, Unit Quiz 4 |
| 5 |  | Unit 5 – SQL Select Part 2 *Aggregates, group by/having window functions* | Problem Set 4, Text Ch 5, Unit Quiz 5 |
| 6 |  | Unit 6 – SQL Advanced Patterns *Set operations, common table expressions, views, complex queries, temporal tables* | Problem Set 5, Text Ch 6, Unit Quiz 6 |
| 7 |  | Unit 7 – Conceptual Data Modeling *Functional and Non-functional requirements. Data Requirements, ER requirements, drawing ER diagrams from ER requirements* | Problem Set 6, Text Ch 7, Unit Quiz 7 |
| 8 |  | Unit 8 – Logical Data Modeling Relational notation. Mapping ER models to Relational Models, Key selection.\* | Problem Set 7, Text Ch 8, Unit Quiz 8 |
| 9 |  | Unit 9 – Database Applications *Database application architectures, CRUD applications, data logic, business logic* | Problem Set 8, Text Ch 9, Unit Quiz 9 |
| 10 |  | Unit 10 - Database Programming *Stored procedures, functions, views, triggers,* | Problem Set 9, Text Ch 10, Unit Quiz 10 |
| 11 |  | Unit 11 – Transactions and Concurrency Control *transaction management, commit / rollback, transaction safety, locks, versioning, deadlocks* | Problem Set 10, Text Ch 11, Unit Quiz 11 |
| 12 |  | Unit 12 – Performance and Indexing *Reading query plans, scans vs seeks, clustered non cluster index, tuning for performance.* | Problem Set 11, Text Ch 12, Unit Quiz 12 |
| 13 |  | Unit 13 – Data Normalization *1st, 2nd and 3rd normal forms. Table redesigns for normal forms, migration of data to new tables* | Problem Set 12, Text Ch 13, Unit Quiz 13 |
| 14 |  | Final Project Q&A | Problem Set 13, Team Project |