

Course Outline (W2024)

COE848: Fundamentals of Data Engineering

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| Instructor(s) | Dr. Faezeh Ensan [Coordinator] Office: ENG324 Phone: (416) 979-5000 x 554904 Email: fensan@torontomu.ca Office Hours: Wednesdays, 1pm - 3pm |
| Calendar Description | Data engineering is core to the effective development of scalable software applications. Rich data management schemes are needed to handle the sizeable Big Data that is available for processing. This course will cover related topics such as entity-relation diagrams, relational databases, data definition and manipulation languages, structured data representations formats, development of novel vocabularies and semi-structured data and also novel concepts in NoSQL databases. |
| Prerequisites | COE 528 |
| Antirequisites | None |
| Corerequisites | None |
| Compulsory Text(s): | 1. Database Systems: The Complete Book, by Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer D. Widom, Prentice Hall, 2nd Edition, 2008, ISBN: 0131873253 |
| Reference Text(s): | |
| Learning Objectives (Indicators) | At the end of this course, the successful student will be able to: <ul style="list-style-type: none"> 1. Use engineering knowledge to solve real world open-ended engineering problems. Use the specialized engineering knowledge to design specific components, systems, or processes. (1c) 2. Use engineering knowledge to solve real world open-ended engineering problems. Use the specialized engineering knowledge to design specific components, systems, or processes. (1d) 3. Anticipate the needs of the project, customize design processes, analyzes progress, and revises plans as necessary. Generate solutions for complex engineering design problems (4a), (4b) 4. Design and develop software tools that adhere to specific project specifications relating to data modeling and data model designs. (5a) 5. Design and implement a data-focused software project. Demonstrate the project to the Teaching Assistant through oral communication and get feedback and evaluate and improve the project modeling and implementation based on the technical feedback (6b) 6. Anticipate legal requirements related to the software project and managing and storing data. Customize modeling and implementation based on these requirements. (9b) 7. Systematically account for professional codes of ethics in data modeling and software design and implementation. (10a) |

| | NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB). | | | | | | | | | | | | | | |
|-------------------------------------|--|---------------|--|--------------|------|------------|------|---------------------|-----|-------------------|--|-------------------------------|------|---------------|--------------|
| Course Organization | 3.0 hours of lecture per week for 13 weeks 1.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks | | | | | | | | | | | | | | |
| Teaching Assistants | Aadi Kalloo: aadi.kaloo@torontomu.ca Omid Shokrollahi: oshokrollahi@torontomu.ca | | | | | | | | | | | | | | |
| Course Evaluation | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2" style="text-align: left;">Theory</th> </tr> </thead> <tbody> <tr> <td>Midterm Exam</td> <td style="text-align: right;">30 %</td> </tr> <tr> <td>Final Exam</td> <td style="text-align: right;">35 %</td> </tr> <tr> <td>In Class activities</td> <td style="text-align: right;">5 %</td> </tr> <tr> <th colspan="2" style="text-align: left;">Laboratory</th> </tr> <tr> <td>Lab Reports and Final Project</td> <td style="text-align: right;">35 %</td> </tr> <tr> <td>TOTAL:</td> <td style="text-align: right;">100 %</td> </tr> </tbody> </table> <p>Note: In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both "Theory and Laboratory" components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the "Course Evaluation" section above for details on the Theory and Laboratory components (if applicable).</p> | Theory | | Midterm Exam | 30 % | Final Exam | 35 % | In Class activities | 5 % | Laboratory | | Lab Reports and Final Project | 35 % | TOTAL: | 100 % |
| Theory | | | | | | | | | | | | | | | |
| Midterm Exam | 30 % | | | | | | | | | | | | | | |
| Final Exam | 35 % | | | | | | | | | | | | | | |
| In Class activities | 5 % | | | | | | | | | | | | | | |
| Laboratory | | | | | | | | | | | | | | | |
| Lab Reports and Final Project | 35 % | | | | | | | | | | | | | | |
| TOTAL: | 100 % | | | | | | | | | | | | | | |
| Examinations | Midterm exam in Week 7, in person, closed book (covers Weeks 1-6). Final exam, during exam period, in-person, closed-book (covers Weeks 1-13). | | | | | | | | | | | | | | |
| Other Evaluation Information | The written reports will be assessed not only on their academic merit, but also on the communication skills of the author as exhibited through the reports. In order to achieve a passing grade in this course, the student must achieve an average of at least 50% in both theoretical and laboratory components. Lab assignments should be submitted before 11:59 pm the day before the scheduled next lab. The penalty for up to 8 hours delay in submission is 20% of the lab mark. More than 8-hours late lab assignments will not be accepted and will receive a mark of 0. | | | | | | | | | | | | | | |
| Teaching Methods | Lectures will be in: Fridays 10:00 AM - 1:00 PM: DSQ15 Theatre | | | | | | | | | | | | | | |
| Other Information | To inquire about the anti-requisites for this course, kindly reach out to the department. | | | | | | | | | | | | | | |

Course Content

| Week | Hours | Chapters / Section | Topic, description |
|-------------|--------------|---------------------------|---|
| 1 | 3 | | Introduction to relational Database Systems |
| 2-3 | 6 | | Entity-Relationship (E/R) Data Model |
| 4 | 3 | | Relational Database Model Subclass Structures to Relations |
| 5 | 3 | | Algebra of Relational Operations |
| 6 | 3 | | Structured Query Language (SQL) |
| 7 | 3 | | Midterm |
| 8 | 3 | | Database Connectivity- Database Modifications Views OOP Access to RDBMS |
| 9 | 3 | | Database Normalization |
| 10 | 3 | | Data Access and Integrity Models-Database Indices |
| 11 | 3 | | Semi-structured Data Representation (XML XML Schema DTD) |
| 12 | 3 | | NoSQL Databases |
| 13 | 3 | | Course Review. |

Laboratory(L)/Tutorials(T)/Activity(A) Schedule

| Week | L/T/A | Description |
|-------|-------|---|
| 2 | - | Project Scope Definition and Project Specification Document Development |
| 3-4 | - | E/R Diagram Design |
| 5-6 | - | Database Design |
| 7-8 | - | Manipulating Data |
| 9-10 | - | Database Programming |
| 11-13 | - | Semi-Structured Data |

University Policies & Important Information

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on [the Senate website](#)

Refer to the [Departmental FAQ page](#) for further information on common questions.

Important Resources Available at Toronto Metropolitan University

- [The Library](#) provides research [workshops](#) and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or students can use the [Library's virtual research help service](#) to speak with a librarian.
- [Student Life and Learning Support](#) offers group-based and individual help with writing, math, study skills, and transition support, as well as [resources and checklists to support students as online learners](#).
- You can submit an [Academic Consideration Request](#) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](#) and select the blue radio button on the top right hand side entitled: **Academic Consideration Request (ACR)** to submit this request.

For Extenuating Circumstances, Policy 167: Academic Consideration allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences more than 3 days in duration and those that involve a final exam/final assessment, require documentation. Students must notify their instructor once a request for academic consideration is submitted. See Senate [Policy 167: Academic Consideration](#).

- If a student is requesting accommodation due to a religious, Aboriginal and/or spiritual observance, they must submit their request via the online [Academic Consideration Request \(ACR\) system](#) **within the first two weeks of the class or, for a final examination, within two weeks of the posting of the examination schedule**. If the required absence occurs within the first

two weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these requests should be submitted with as much lead time as possible in advance of the required absence.

- If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The [Remote Learning Guide](#) for students includes guides to completing quizzes or exams in D2L Brightspace, with or without [Respondus LockDown Browser and Monitor, using D2L Brightspace](#), joining online meetings or lectures, and collaborating with the Google Suite.
- Information on Copyright for [Faculty](#) and [students](#).

Accessibility

- Similar to an [accessibility statement](#), use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about [Academic Accommodation Support](#).
- Learn [how to register with AAS](#).

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration and how to access each](#).

Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:** 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:** 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via [My SSP app](#) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email csdc@torontomu.ca
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email osvse@torontomu.ca
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](#) website.