

**Course Outline (W2025)**

**BME802: Human-Computer Interaction**

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|-----------------------------|---|
| <b>Instructor(s)</b>        | Ghassem Tofighi [Coordinator]<br>Office: online - by appointment<br>Phone: TBA<br>Email: gtofighi@torontomu.ca<br>Office Hours: online - by appointment   |
| <b>Calendar Description</b> | Principles underlying the design, evaluation and implementation of interactive computing systems as well as the major research topics associated with such systems. Technical breakdown of interfaces that are multi-media based front-ends to complex networks. Graphical user interfaces will be introduced along with the related physiological and human factors issues. Design of interfaces using virtual reality, the Internet, and other advanced development tools. Commonly integrated media such as video, graphics, and audio capabilities will be examined. User-centered technology will be a primary theme using the design of web pages and medical device design as hands-on applications. |
| <b>Prerequisites</b>        | BME 506, BME 639, BME 674 and BME 634   |
| <b>Antirequisites</b>       | None  |
| <b>Corerequisites</b>       | None  |
| <b>Compulsory Text(s):</b>  | 1. Information, Sensation and Perception, Norwich, K.H.,2003<br><a href="http://www.biopsychology.org/norwich/isp/isp.htm">http://www.biopsychology.org/norwich/isp/isp.htm</a>   |
| <b>Reference Text(s):</b>   | 1. Engineering Psychology and Human Performance, Wickens, C., Hollands, J., Banbury, S., and Parasuraman, R.; Pearson, 2013<br>2. Guyton and Hall Textbook of Medical Physiology, Recent Edition. Hall, J.E., Elsevier, 2021.   |

| <b>Learning Objectives (Indicators)</b> | <p>At the end of this course, the successful student will be able to:</p> <ol style="list-style-type: none"> <li>1. Demonstrates methodology to evaluate human perception limits for a user interface modality. (1d Specialized engineering). <b>(1d)</b></li> <li>2. Predicts unstated customer and user needs. Defines design parameter uncertainties and their impacts (4a Problem Definition). <b>(4a)</b></li> <li>3. Evaluates and selects appropriate models, and tools tools for measuring variables in question (5a Use scientific techniques and engineering tools). <b>(5b)</b></li> <li>4. Make Concise Technical Presentation to a Peer Group (7b Oral). <b>(7b)</b></li> <li>5. Application of Public Interest in Decision Making (8b Public Interest). <b>(8b)</b></li> <li>6. Evaluation of project scope, critical assumptions and deliverables with stakeholders (11b - Project Management). <b>(11b)</b></li> <li>7. Gains a working knowledge of the literature of the field (12b Professional Development). <b>(12b)</b></li> </ol> <p><b>NOTE:</b>Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p> |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
|---|--|--------|--|--------------|------|------------|------|------------|--|------|------|----------------|------|------------------|------|--------|-------|
| <b>Course Organization</b>              | <p>3.0 hours of lecture per week for 13 weeks<br/>2.0 hours of lab per week for 12 weeks<br/>0.0 hours of tutorial per week for 12 weeks</p>   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| <b>Teaching Assistants</b>              | <p>TBA</p>   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| <b>Course Evaluation</b>                | <table border="1"> <thead> <tr> <th colspan="2">Theory</th></tr> </thead> <tbody> <tr> <td>Midterm Exam</td><td>20 %</td></tr> <tr> <td>Final Exam</td><td>30 %</td></tr> <tr> <th colspan="2">Laboratory</th></tr> <tr> <td>Labs</td><td>20 %</td></tr> <tr> <td>Design Project</td><td>10 %</td></tr> <tr> <td>Research Project</td><td>20 %</td></tr> <tr> <td>TOTAL:</td><td>100 %</td></tr> </tbody> </table> <p><b>Note:</b> 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 "<b>Theory and Laboratory</b>" 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 "<b>Course Evaluation</b>" section above for details on the Theory and Laboratory components (if applicable).</p>   | Theory |  | Midterm Exam | 20 % | Final Exam | 30 % | Laboratory |  | Labs | 20 % | Design Project | 10 % | Research Project | 20 % | TOTAL: | 100 % |
| Theory                                  |  |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| Midterm Exam                            | 20 %   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| Final Exam                              | 30 %   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| Laboratory                              |  |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| Labs                                    | 20 %   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| Design Project                          | 10 %   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| Research Project                        | 20 %   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| TOTAL:                                  | 100 %  |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| <b>Examinations</b>                     | <p>Midterm exam in class. Final exam during exam period.</p>   |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| <b>Other Evaluation Information</b>     | <p>Final exam will be cumulative.</p>  |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |
| <b>Teaching Methods</b>                 | <p>Lectures with slides presented in class and posted on D2L.</p>  |        |  |              |      |            |      |            |  |      |      |                |      |                  |      |        |       |

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| <b>Other Information</b> | Course content and Lab schedules may vary as discussed in lectures |
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## Course Content

| Week | Hours | Chapters / Section          | Topic, description  |
|------|-------|-----------------------------|---|
| 1    | 3     | Norwich 2, 11,12, Wickens 1 | Introduction to HCI and Outline<br>Human-in-the-loop Systems<br>Definitions, Technology history, and evolution<br>Introduction to Psychophysics |
| 2    | 3     | Norwich 3, Wickens 2        | Signal Detection Theory<br>Stimulus-Response Matrix<br>Sensitivity<br>Experimental paradigms  |
| 3    | 3     | Norwich 4-7, 14, Wickens 2  | Criteria, Bias, Decision Strategy<br>Information Theory<br>Human Perception: Entropy Theory<br>Channel Capacity                                 |
| 4    | 3     | Norwich 14, Wickens 3       | Redundancy<br>Vision and Extraocular Muscles<br>Sleep Signals<br>Visual Processing  |
| 5    | 3     | Norwich 13, Wickens 9       | Choice of Action: Uncertainty<br>Reaction Times<br>Speed vs. Accuracy   |
| 6    | 3     |                             | Midterm Exam  |
| 7    | 3     | Wickens 10,12               | EMG, Hands-free interfaces<br>Thermal Imaging<br>Eye Movements<br>Vestibular System, Accelerometers<br>Vestibulo-ocular, Vestibulo-colic Reflex |

|    |   |              |  |
|----|---|--------------|--|
| 8  | 3 | Wickens 6    | Spectrogram<br>Hearing and Sound Cues<br>Written and Spoken Language<br>Icons, Codes                                     |
| 9  | 3 | Wickens 9,11 | Processing strategies<br>Articulation Index<br>Usability Testing<br>Design Guidelines and Aids                           |
| 10 | 3 | Wickens 4    | Vision and Extraocular Muscles<br>Depth Perception<br>2D vs. 3D Displays<br>Orientation and Motion                       |
| 11 | 3 | Wickens 5    | Virtual and Augmented Reality<br>Advanced Displays and Navigation<br>Verbal vs. Spatial Mapping<br>Learning and Training |
| 12 | 3 | Wickens 3    | Attention, Display Design<br>Focused, Divided, Selective Attention<br>Target Search, Vigilance<br>Cost Benefit Analysis  |
| 13 | 3 | Wickens 7,8  | Processing: Memory<br>Working vs. Long Term Memory<br>Encoding, Storage, Retrieval<br>Processing: Decision Making        |

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

| Week | L/T/A | Description                                      |
|------|-------|--|
| 3-5  | Lab   | 1. Psychophysical Experiment Instructional Video |
| 6-7  | Lab   | 2. Sleep Biometrics                              |

|       |     |                              |
|-------|-----|------------------------------|
| 8-10  | Lab | 3. Hands-free Interfaces     |
| 11-13 | Lab | 4. Website Usability Testing |

## 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 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](mailto:csdc@torontomu.ca)
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email [osvse@torontomu.ca](mailto: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.