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## Course Syllabus and Outline

Western University

Faculty of Engineering

*School of Biomedical Engineering*

# BME 3301A - "Neural Systems Engineering."

## COURSE OUTLINE – 2020-21

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**CALENDAR  
DESCRIPTION:**

Engineering principles relevant to the study of neurophysiology, neural modelling, and the design of neural systems for diagnostic, interventional, and rehabilitation applications.

**COURSE  
INFORMATION:**

Course  
Coordinator:

Milad Khaki

Office:

E-mail: [mkhaki@uwo.ca](mailto:mkhaki@uwo.ca)

Lectures:

Milad Khaki

Tutorials:

Milad Khaki

Teaching  
Assistant:

Lingkai (Kyle) Tang: [ltang232@uwo.ca](mailto:ltang232@uwo.ca)

**PREREQUISITE:**

BME 3201A/B (Fundamentals of Biomedical Engineering Design)

**PRE- or  
COREQUISITES:**

BME 4455A/B (Interdisciplinary Biomedical Modeling), Physiology 2130 (Human Physiology)

**ACCREDITATION  
UNITS:**

Engineering Science 75%, Natural Science 25%

**TOPICS:**

- Neural physiology and modelling
- Motor control
- EEG and EMG systems and signal processing
- Functional MRI and other neural imaging technologies
- Neural electrode devices and brain-computer interfaces
- Neural prosthetic devices and neurorobotics
- Interventional and therapeutic neural technologies

**COURSE  
OBJECTIVES:**

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

1. Biosensing cardiovascular, respiratory, and neuromuscular physiology;
2. Create experiments and study design of add-on circuits using the breadboards;
3. Compare a raw biosignal and conditioned signal;

**GENERAL LEARNING OBJECTIVES (CEAB Graduate Attributes):**

Knowledge Base	×	Use of Engineering Tools	×	Impact on Society and the Environment	
Problem Analysis	×	Individual and Team Work	×	Ethics and Equity	
Investigation		Communication Skills	×	Economics and Project Management	
Design	×	Professionalism		Life-Long Learning	

**CONTACT HOURS:** Three lecture hours per week, three additional hours, four times per term. 0.5 course.

Bin He, ed., *Neural Engineering*, 2nd ed., New York: Springer, 2013, ISBN 978-1-4614-5226-

**TEXT:**

The final course grade will be determined as listed below:

**EVALUATION:**

Deadline dates for assignments, projects, presentations, and examinations are determined according to the **tentative** schedule as follows:

The final grade is computed as follows:

**Assignments:** 20% (5 assignments) (Sep 22, Oct 6, Oct 20, Nov 3, Nov 17)

**Laboratories:** 30% (4 lab exercises) ( Sep 25, Oct 16, Nov 6, Nov 20)

**Midterm:** 20% (Oct 30, 2020)

**Final Exam:** 30% (15% written, 15% verbal) (TBA)

Tests and examinations in this course will be conducted using both Zoom and the remote proctoring service, Proctortrack.

When Zoom is used for exam invigilation, you will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session using Zoom will **not** be recorded.\*

Proctortrack will require you to provide **personal information** (including some biometric data). The session will be **recorded**. By taking this course, you are consenting to the use of this software. More information about remote proctoring is available in the Online Proctoring Guidelines at the following link:

<https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>.

Completion of this course will require you to have a reliable internet connection and a device that meets the system and technical requirements for both Zoom and Proctortrack. Information about the system and technical requirements are available at the following links:

<https://www.proctortrack.com/tech-requirements/>,

<https://support.zoom.us/hc/en-us>.

\* Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please discuss this with your instructor in advance of the test or examination.

**E-MAIL POLICY:**

While e-mail is a useful tool for coordinating office hour appointments or for simple clarification, an in-person meeting is recommended to address more complex questions. Please make an appointment to discuss any personal, academic, group work or controversial issues in person, especially any concerns that you might have about your grades. Prof. Ferreira will check e-mail Monday through Friday during regular office hours; you can expect a response within 24 hours during the workweek. Over weekends and holidays, Prof. Ferreira will not be checking e-mail.

regularly, so plan accordingly. Due to increased demand, e-mails sent after 4:00 PM the day before a Term Test may not be responded to before the test.

**CLASSROOM  
RESPONSE SYSTEM:**

We will periodically be make use of the free PressWestern Virtual Clicker classroom response system ([http://presswestern.uwo.ca/students\\_and\\_audience/virtual\\_clickers.html](http://presswestern.uwo.ca/students_and_audience/virtual_clickers.html)) in class. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablet or laptop computer.

**ATTENDANCE:**

Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Associate Dean (Graduate) (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student will be debarred from taking the regular examination in the course.

**HEALTH/  
WELLNESS:**

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on-campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please consult the Faculty of Music web page (<http://www.music.uwo.ca/>) and our own McIntosh Gallery (<http://www.mcintoshgallery.ca/>). Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

**CONDUCT:**

Students are expected to arrive at lectures on time and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.

**ACCESSIBILITY:**

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 for any specific questions regarding an accommodation.

**ACCOMMODATION  
POLICIES:**

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: [Academic Accommodation for Students with Disabilities](#).

**Academic Consideration for Student Absence**

Students will have up to two (2) opportunities during the regular academic year to use an online portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration,

and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling Office of a student's Home Faculty.**

For Western University policy on Consideration for Student Absence, see

[Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs](#)

Moreover, for the Student Medical Certificate (SMC), see:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

### **Religious Accommodation**

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements are affected by a religious observance. Additional information is given in the [Western Multicultural Calendar](#).

**Learning Outcomes (BME 3301)**

Degree Level Expectation	Weight	Assessment Tools	Outcomes
<b>Depth and breadth of knowledge</b>	25%	<ul style="list-style-type: none"> <li>In-class quizzes</li> <li>Term Tests</li> <li>Lab reports</li> </ul>	<ul style="list-style-type: none"> <li>Be aware of significant current problems in the field of study</li> <li>Understands computational and/or empirical methodologies to solve related problems</li> </ul>
<b>Knowledge of methodologies</b>	40%	<ul style="list-style-type: none"> <li>In-class quizzes</li> <li>Term Tests</li> <li>Lab reports</li> </ul>	<ul style="list-style-type: none"> <li>Be able to identify and describe the underlying principles behind techniques used in the field</li> <li>With guidance, be able to apply the methodologies to design solutions to similar problems.</li> <li>Obtain information from the library, online and literature resources that will support the solving of research problems.</li> </ul>
<b>Application of knowledge</b>	15%	<ul style="list-style-type: none"> <li>In-class quizzes</li> <li>Term Tests</li> </ul>	<ul style="list-style-type: none"> <li>Able to apply knowledge in a rational way to analyze a particular problem</li> <li>Able to use a coherent approach to design a particular engineering system using existing design tools</li> </ul>
<b>Communications skills</b>	5%	<ul style="list-style-type: none"> <li>Lab reports</li> </ul>	<ul style="list-style-type: none"> <li>Be able to prepare analytical, organized and concise written reports and oral presentations that effectively communicate scientific content to other peers.</li> </ul>
<b>Awareness of the limits of knowledge</b>	15%	<ul style="list-style-type: none"> <li>Term Tests</li> <li>Lab reports</li> <li>In-class quizzes</li> </ul>	<ul style="list-style-type: none"> <li>Recognize assumptions and limitations in the scientific models and simulations, and propose their possible impact on the results.</li> </ul>

 [BME 3301NeuralSystemsEngineering\\_CourseOutline\\_Final.pdf](#)