

# MEng Student Handbook 2019-20



Institute of Biomaterials  
& Biomedical Engineering  
UNIVERSITY OF TORONTO

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## 1.0 REGISTRATION POLICIES AND PROCEDURES

Students registered as full-time students in the School of Graduate Studies must be engaged in their studies on a full-time basis, as required by government regulations for full-time graduate studies.

Full-time graduate students are defined according to government regulations as follows:

1. They must be pursuing their studies as a full-time occupation and identify themselves as full-time graduate students.
2. They must be designated by the University as full-time students.
3. They must be geographically available and visit the campus regularly.
4. They must be considered a full-time student by their supervisors.
5. If an academic program requires an absence from the University, students must apply through their graduate unit for permission to be off campus.

A full-time student may be absent from the University for an extended period or may participate in a program offered by another university if, and only if, the student has received written permission from the graduate unit in which he or she is registered. A graduate student who, in a given session, is absent from the University without receiving prior approval may lose good academic standing. In exceptional cases, a graduate unit may recommend to the School of Graduate Studies the termination of the student's registration and eligibility.

<http://www.sgs.utoronto.ca/calendar/Pages/Registration-and-Enrolment.aspx>

### 1.1 Registering in your Program

Students must register annually, in September, for each year of the program. New students must have cleared all conditional offers of admission prior to registration by submitting a final official transcript reflecting final grades and evidence of degree conferral to the Institute.

The School of Graduate Studies sends all registration material to students between July and August. If you have not received this information by mid-August, you should contact the graduate unit.

The initial payment of academic and incidental fees will ensure the student is registered in the program. Payment of fees must be made through a Canadian bank, payable to the University of Toronto in Canadian funds. Failure to register as required will cause the student's candidacy's status to lapse.

The SGS website is the most up-to-date place to find information on registration, fees, and University of Toronto policy. One very important link you may wish to use is:

<http://www.sgs.utoronto.ca/currentstudents/Pages/Graduate-Fees.aspx>

This link will provide you with detailed information on the both tuition fees and payment schedules.

## **1.2 Late Registration**

Students are responsible for ensuring proper registration by the appropriate deadlines. Late registration will be subject to an additional fee as outlined by the School of Graduate Studies.

## **2.0 PROGRAM REQUIREMENTS**

The MEng program in Biomedical Engineering is aimed at individuals who plan to move directly into industry to work in biomedical device development, specifically to design and commercialize technologies and solve medically-relevant problems.

The program is a full-time three session, non-thesis degree based on coursework in engineering, biomedical sciences and entrepreneurship. Moreover, the program requirements include a practical experience in applied research in the form of a capstone, in industry, hospitals, governmental or academic research laboratories.

The program is made up of a total of 5.0 full-course equivalent (FCE) credits. Most of the courses in engineering are worth 0.5 FCE (i.e. one semester). Therefore, the program is composed of seven half-credit courses (or 3.5 FCE) followed by a three half-credit equivalent internship (at least 1.5 FCE).

Students can choose from courses offered at IBBME and those offered at other departments in the Faculty of Applied Science and Engineering (FASE). At IBBME, courses are categorized under three fields:

- 1) Molecular Engineering
- 2) Tissue Engineering
- 3) Clinical Engineering

Note that some areas of interest for MEng students may overlap with two (or more) fields, so course selection does not need to be restricted to a specific field.

Session	Courses / Requirements	Total
Session 1 Fall 1.5 - 2.0 FCE	<ul style="list-style-type: none"> <li>• 0.5-FCE in commercialization and entrepreneurship courses</li> <li>• 1.0-FCE in additional BME courses</li> </ul>	<ul style="list-style-type: none"> <li>• 1.0 FCE in Commercialization and entrepreneurship course <ul style="list-style-type: none"> <li>- 0.5 FCE has to be in BME1800H or BME1801H</li> </ul> </li> <li>• 2.0 FCE course relating to biomedical engineering</li> <li>• 0.5 FCE additional graduate course</li> </ul>
Session 2 Winter 1.5 - 2.0 FCE	<ul style="list-style-type: none"> <li>• 0.5-FCE in commercialization and entrepreneurship courses</li> <li>• 1.0-FCE in additional BME courses</li> <li>• 0.5-FCE in a graduate course of your choice</li> <li>• Mandatory information session with Industrial Liaison Officer in January</li> </ul>	
Session 3 Summer 1.5 FCE	<p>BME1899 Practical Experience in Applied Research (1.5 FCE)</p> <ul style="list-style-type: none"> <li>• Prior to starting internship submit* an agreement form</li> <li>• If the position is new to IBBME submit an internship proposal form</li> <li>• Submit an interim report midway through the internship</li> <li>• Submit a final report within 2 weeks of internship completion</li> <li>• Complete 2 professional development modules</li> </ul> <p>*All submission are on Quercus</p>	<ul style="list-style-type: none"> <li>• 1 Practical experience course</li> <li>• Complete 2 professional development modules</li> </ul>

Note that the student can choose to have a 2.0 FCE session during the Winter (session 2) instead of the Fall (session 1), as long as the sum of FCEs for the Fall and Winter is 3.5 FCE. The internship will normally be scheduled during the third term, (summer session). It is not recommended to plan to take courses during the summer since very few courses are offered at that time. Any change to the program order may risk affecting time to completion

## 2.1 Course Requirements

- 1.0 FCE in commercialization and entrepreneurship courses such as BME1800H, BME1801H, BME1802H, BME1405 or others.
  - o 0.5 FCE of the 1.0 FCE must be in BME1800H or BME1801. The other 0.5 FCE can be in any other course that fall under commercialization and entrepreneurship (e.g. BME1802, BME1405 or see the appendix for a list of qualifying courses).
- 2.0 FCE in biomedical engineering and biomedical sciences courses
  - o These courses are all courses offered in the discipline of engineering and medicine; these include all IBBME course offerings and applicable courses offered by the Faculty of Medicine, Dentistry and Applied Science and Engineering
  - o Biomedical engineering courses categorized as biomedical engineering courses are drawn from IBBME's research fields, MEng students have the option to select

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courses that best align with their interest. Examples of possible curriculum pathways have been prepared for each of the four research fields (Appendix A and Appendix B). However, students are also encouraged to consider courses outside IBBME. For instance, departments in the Faculty of Medicine may offer appropriate Biomedical Sciences courses; other departments in the Faculty of Applied Science and Engineering (such as MIE, CHE or ECE) may offer appropriate courses.

- 0.5 FCE can be a half course in either biomedical engineering, commercialization and entrepreneurship, or any graduate level course the student is interested and is applicable to the degree.
  - o APS courses from the ELITE program (<http://gradstudies.engineering.utoronto.ca/professional-degrees/elite-certificate/>) are also an option.
- 1.5 FCE Practical Experience in Applied Research course in biomedical device development, usually over one session for the full-time option (BME1899Y), or over three sessions for the part-time option (BME1898Y)
- All courses must be graduate level, which includes both 500- and 1000-level. Students can take a maximum of one 500-level course.

A list of courses relevant to the proposed program, as well as links to courses listed in other departments are presented in Appendix B.

### How to select courses:

**IBBME:** Begin by reviewing the course options on the IBBME website:

- Current course offerings: <https://ibbme.utoronto.ca/current-students/course-calendar/>
- Course descriptions: <https://ibbme.utoronto.ca/current-students/course-calendar/course-descriptions/>

Should you require additional information regarding the courses, including syllabi, reach out to the professor teaching the course.

**Outside IBBME:** A good starting point to selecting a graduate course outside IBBME and obtaining approval is to check Appendix B and enquire directly with the graduate office of the department offering the course. If the course is available, obtain a course description and the list of prerequisite courses (if applicable) and provide our graduate office with this information. While the graduate office can provide some advice on course selection, ultimately, it is the responsibility of the students to select courses that are compatible with their interest and level of expertise in a particular discipline.

A list of courses relevant to the proposed program, as well as links to courses listed in other departments are presented in Appendix B.

## 2.2 BME1899: Practical Experience in Applied Research Requirements (1.5 FCE)

One of the most unique and exciting components of the MEng Program is the opportunity to acquire practical experience and knowledge during the internship component, as part of BME1899. Commonly undertaken in the summer, and ideally is carried out in industry, private consulting firms, hospitals or government institutions.

### Internship timeline overview:

#### Fall:

- Familiarize yourself with internship opportunities previously undertaken by IBBME students using the database on Quercus
- Research companies and positions of interest
- Begin applying for positions
- Complete two professional development activities at the career center (<https://clnx.utoronto.ca/myAccount/events/sgevents.htm>)
  - o The Resume & Cover Letter workshop is required
  - o Another professional development workshop of your choice from the following:
    - Talking to Professionals
    - LinkedIn Lab
    - Practice your interview
    - iLEAD workshops

#### Winter

- Attend internship information session
- Continue applying to postings
- Secure a position

#### Summer

- Complete an agreement form with your supervisor
- Commence internship
- Submit an Interim report midway through your internship
- Submit a final report by Aug 31<sup>st</sup> and complete internship

### Internship expectations

Students will be expected to cover four important aspects of biomedical device development during their internship:

1. Clinical, medical or health needs assessment (need of healthcare providers and patients). For this project component, the students will apply concepts mainly related to their Biomedical Science courses.
2. Concept development (literature and patent searches, input from experts). For this project component, the students will apply concepts related to their Engineering, Entrepreneurship, Biomedical Science courses.

3. Design and prototyping. For this project component, the students will apply concepts mostly related to their Engineering and Biomedical Sciences courses.
4. Development of business models. For this project component, the students will apply concepts mostly related to their Entrepreneurship courses.

### **Appropriate internships**

While there is considerable flexibility as to the types of internships a student can take, the internship needs to be relevant to clinical engineering, and as such should include significant aspects of work pertaining to engineering/technical work in a clinical/medical setting. The internship opportunities provided by our office (i.e. our databased on Quercus or circulated postings) will be approved as appropriate. You do not need to seek approval for these prior to applying. However, if you find a new internship opportunity on your own that has not previously been approved by IBBME, or if you are unsure if a particular position is appropriate, fill in a New Internship Proposal form and submit it on Quercus in order to seek approval prior to accepting or commencing with the internship.



## Obtaining an Internship

The Professional programs office provides information to MEng students about available internship positions, on a continual basis through emails and by updating the database of current and previous internship placements on Quercus.

Students are expected to use this information and these resources to proactively seek their own internship opportunities. While the internships are mandatory, there is no guarantee that the Professional programs office will be able to provide internships to every student.

If the internship you are undertaking has not previously been offered by IBBME and is not found in the internship database on Quercus you need to submit an Internship proposal form. Approval of the internship position prior to your acceptance of the internship is necessary. An internship proposal form doesn't not negate the need for an Internship Agreement Form.

### BME1899 requirements

All forms/ reports are located and should be submitted on the MEng group on Quercus.

1. **Workshops:** Two professional development workshops at the career center
  - a. Cover letter and Resume workshop and another workshop of your choosing
2. **Agreement Form:** Due upon securing an internship you are to complete the form along with your supervisor
3. **Interim report:** Due midway through your internship
4. **Final Report:** Due within 2 weeks of completing your internship or Aug. 31<sup>st</sup>, whichever is sooner

### Evaluation

BME1899 is evaluated on a completion basis. Complete the 4-month full time placement and submit all of the above reports to receive credit for the course.

## 3.0 ENROLMENT AND COURSE WORK

Students are able to select appropriate courses directly on ACORN, by following the MEng guidelines. Students will be automatically enrolled in the practical experience course BME1899. Enrollment into other courses including the BME1800, BME1801, BME 1405 and others is on a first come first serve basis and while spaces remain.

To ensure registrations, student should pay fees by the deadline indicated on their student account.

### 3.1 Adding and Dropping Courses

Students who wish to add or drop courses following the SGS deadline for enrolment must complete an Add/Drop Form. The form must be submitted to the department after obtaining all necessary approvals. A student will not be able to add or drop courses after the prescribed

deadlines of the department. The Institute's prescribed deadlines for changes are **one week prior** to the deadline dates scheduled at the School of Graduate Studies. For more information, see the SGS website at <https://www.sgs.utoronto.ca/currentstudents/Pages/Sessional-Dates.aspx>

### 3.2 Grading and Evaluation

Students normally receive a grade report for all courses completed within a given term. These reports are not official transcripts. Students requesting official transcripts must order them from the University of Toronto Transcript Centre located in the Sidney Smith Building at 100 St. George Street. Students may also obtain grades from the Student Web Service at <http://www.acorn.utoronto.ca/>.

Additional information relating to grading scales and grading policies are found in the SGS Calendar under the section titled Graduate Grading and Evaluation Practices Policy.

### 3.3 Extra Courses Not Required for the Degree

Enrolments for additional courses not required for the degree are subject to the same regulations as those in the degree program. Students should check with the host department about course enrolment procedures.

Students are welcome to enroll in as many courses as they believe they successfully complete. Graduate fees are a lump sum payment, therefore there are not additional charges for extra or additional courses.

### 3.4 Academic Standing and Satisfactory Progress

Students must maintain satisfactory performance in their courses and progress in their internships in order to remain in *Good Standing* with SGS and IBBME during completion of their degree program. The passing mark is B- in all courses, i.e. 70%.

After each session, the Departmental Graduate Studies Committee will consider the cases of those students who have failed one graduate course. Students with one failure who are allowed to proceed will have their cases reviewed by the Graduate Office. Students who find themselves in this situation are strongly encouraged to contact Accessibility Services ([www.accessibility.utoronto.ca](http://www.accessibility.utoronto.ca)) to determine if accommodations can be put in place to meet specific needs they may have. The Graduate Office's policy is to recommend to SGS the termination of the registration of students who at any time accumulate two failing grades. Consequently, failing courses can have very severe consequences and difficulties should be addressed as soon as possible. Failure to remain in good standing can affect a student's registration and continuation in their program.

Please review SGS policy on Program Progress and Good Standing:

<http://www.sgs.utoronto.ca/calendar/Pages/Good-Academic-Standing-Satisfactory-Academic-Progress-Time-Limits-Supervision-Candidacy.aspx>

## 4.0 GENERAL INFORMATION

### 4.1 Ethics and Safety

Some of the research undertaken in IBBME, including that in internship courses, is required to comply with specific ethical review programs (animal or human) and safety regulations (chemical, biological, radiation). You must be aware of these requirements and may have to attend specific training courses as required by the specific organization sponsoring your internship.

### 4.2 Intellectual Property and the Graduate Student

Students must be aware of the issues around Intellectual Property and their research, if applicable. Please refer to the SGS website (<https://www.sgs.utoronto.ca/currentstudents/Pages/Intellectual-Property.aspx>) for updates and guidelines.

### 4.3 Plagiarism and other Cases of Academic Misconduct

Students in graduate studies are expected to commit to the highest standards of integrity and to understand the importance of protecting and acknowledging intellectual property.

The University's policy on academic misconduct is found in the *Code of Behaviour on Academic Matters* can be found on the SGS website under Information for Students. It is the student's responsibility to be aware of these policies. In particular, make sure you know exactly what is considered plagiarisms in the context of your progress reports, proposal, manuscripts and thesis and how to avoid it.

<http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize>

<http://www.sgs.utoronto.ca/currentstudents/Pages/Academic-Integrity-Resources.aspx>

### 4.4 Program Withdrawal and Termination of Registration

The Graduate Office may request to SGS the termination of the registration of students who have failed two or more graduate courses. Normally, the Graduate Office will give student the chance to voluntarily withdraw from the program within a defined time period before the request for termination is formalized with SGS (a termination status can have serious consequences as it is permanently recorded on student transcripts). However, it is important to note that termination can be appealed to the Graduate Academic Appeals Board of SGS but that withdrawal cannot. Students in this situation are encouraged to obtain additional information about appeals and withdrawals from SGS in order to make their decision.

<http://www.sgs.utoronto.ca/facultyandstaff/Pages/Termination-Student-Info.aspx>

### 4.5 Change of Address

Students are responsible for updating any address and/or telephone changes via the Student

Web Services at <http://www.acorn.utoronto.ca/>. In addition, students should also inform the Graduate Office and the Administrative Office in writing.

#### 4.6 Student Cards and E-mail Address

To gain full access to the University of Toronto library, registered students are required to obtain a photo-ID card (TCard), which serves as a library card and a student card. The TCard can be obtained from the Robarts Library, Room 2054. The library requires students to show two pieces of identification, including citizenship, valid photo ID, and a document indicating your student number. Information on the TCard and instructions in creating email addresses can be found at <http://www.its.utoronto.ca/>. Students also have access to a large volume of biomedical engineering reference books located in the library of the Institute.

Your University of Toronto email address is the official contact point for all University-related announcements and notices posted by the School of Graduate Studies and your Graduate Unit. Please note that, for security purposes, Faculty and Graduate Offices are prohibited from opening emails that do not come from a University of Toronto account. You are responsible for ensuring that this account is checked regularly.

#### 4.7 Leaves of Absence and Student Personal Time Off

Guidelines on Leaves of Absence (<http://www.sgs.utoronto.ca/calendar/Pages/Registration-and-Enrolment.aspx>)

Graduate students may apply to their Graduate Office for a one-session to three-session leave during their program of study for:

- 3.0 **serious health or personal problems** which temporarily make it impossible to continue in the program; or
- 4.0 **parental leave** by either parent at the time of pregnancy, birth or adoption, and/or to provide full-time care during the child's first year. Parental leave must be completed within 12 months of the date of birth or custody. Where both parents are graduate students taking leave, the combined total number of sessions may not exceed four.

Once on leave, students will not be registered, nor will they be required to pay fees for this period unless they wish to maintain some of their health services. In general, students on leave may not make demands upon the resources of the university, attend courses, or expect advice from their supervisors. Students on leave will not be eligible to receive University of Toronto financial assistance. In the case of other graduate student awards, the regulations of the particular granting agency apply.

Students may make application for a leave by completing the leave of absence form (<http://www.sgs.utoronto.ca/Documents/Leave+of+Absence.pdf>) and submitting it to the IBBME Graduate Office for approval. The form is then sent to the School of Graduate Studies for processing. The termination date of the degree program will be extended by the duration of the leave taken, i.e., one, two, or three sessions as appropriate. Except for parental leave or in

exceptional circumstances, it is not expected that a student will be granted more than one leave under the terms of this policy. Normally the start and finish of the leave would coincide with the start and end of a session.

#### 4.8 Graduate Course Grade Scales

The Table below presents the grade scale for graduate courses. IBBME requires the completion of every course taken for graduate credit with a least a mark of B- (or 70%). However, eligibility for most graduate scholarships requires a GPA of at least A-. A grade below 70% is inadequate and indicated on the transcript by FZ (fail) and cannot be counted for credit. A student who has received an FZ in a course should speak with the Graduate Coordinator to get the permission to either repeat the course or substitute another one. This permission may be given to the student if his/her marks in other course(s) taken is/are above the minimum required. Normally, a student will not receive this permission more than once. If a student fails two courses, the Graduate Office will recommend to SGS termination of student's registration in the program.

<i>Graduate</i>	
<b>Truncated Refined Letter Grade Scale</b>	<b>Numerical Scale of Marks</b>
<b>A+</b>	<b>90 - 100%</b>
<b>A</b>	<b>85 - 89%</b>
<b>A-</b>	<b>80 - 84%</b>
<b>B+</b>	<b>77 - 79%</b>
<b>B</b>	<b>73 - 76%</b>
<b>B-</b>	<b>70 - 72%</b>
<b>FZ**</b>	<b>0 - 69%</b>

**\*\*FZ = Fail**

<http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/grading.pdf>

#### **4.9 Policy on Extension and Late Withdrawal Requests for Graduate Courses**

A request for an Extension in a graduate course should be sent to the Instructor **within two business days after deadline** for completing that particular component of the course. The request must be supported by medical documentation (see <http://www.illnessverification.utoronto.ca>), if the reason for the request is due to an illness.

If the extension required for the completion of the coursework is beyond the original SGS deadline to submit the marks for that course (e.g. past the end of the session) then the request will have to be sent to the Graduate Office. Students will petition the graduate unit for extensions, using a standard form provided by SGS (<http://www.sgs.utoronto.ca/Documents/Extension+to+Complete+Coursework.pdf>).

We strongly recommend that students request an extension instead of a late withdrawal for course whenever applicable. A request for a late withdrawal for a course should be sent to the Graduate Office as soon as possible during the session in which the course is offered. Such requests are approved only for exceptional circumstances such as a very serious illness or bereavement. These requests must be supported by appropriate medical documentation (<http://www.illnessverification.utoronto.ca>), if the reason for the late withdrawal is due to a medical condition. The Graduate Office is not likely to approve a request for a late withdrawal after the final course marks have been communicated to the students.

<http://www.sgs.utoronto.ca/calendar/Pages/Registration-and-Enrolment.aspx>

Requests for Extensions or Late Withdrawals may be granted or denied by the Graduate Office. In the case of an extension, if the course is never completed by the deadline prescribed by the Graduate Office, then the report of INC (incomplete) is permanently recorded on the student's transcript.

#### **4.10 Academic Appeals (for a course mark, course failure or other academic decisions)**

Note that decisions made by Instructors, Supervisors and the Graduate Office can be appealed. Academic appeals are initiated within IBBME (with the exception of appeals related to Termination of Registration and Final Oral Examination failure which are appealed directly at the SGS level). When possible, the Graduate Office or the Director will provide assistance to attempt to settle the appeals informally between the parties involved (e.g. student, instructor).

If a student wants to appeal a decision made by the Graduate Office, the first step in the process is to send a notice of appeal (<http://www.sgs.utoronto.ca/Documents/GDAAC+Notice+of+Appeal.pdf>) to the Professor chairing IBBME's Graduate Department Academic Appeals Committee (GDAAC). The GDAAC will review the case and will make a recommendation to IBBME's Director (or his/her substitute) who then makes a decision. The appeal can then subsequently be taken to the Graduate

Academic Appeals Board (GAAB) of SGS, and then to the Academic Appeal Committee of the Governing Council of the University.

<http://www.sgs.utoronto.ca/facultyandstaff/Pages/Graduate-Academic-Appeals.aspx>

<http://www.sgs.utoronto.ca/calendar/Pages/Academic-Appeals-Policy.aspx>

#### **4.11 BESA (BioEngineering Student Association)**

BESA represents and promotes the student community at the Institute. They organize many of the social events for our students, and are quite busy listening to students expressing their views, ideas, or concerns related to any matters. Further information about BESA can be found at <http://besa.ibbme.utoronto.ca/>

#### **4.12 The Essential Grad Guide**

The Essential Grad Guide is a booklet for new students that contains information about registration and services offered by SGS and the University of Toronto. The electronic copy of the booklet is posted on the SGS website at <http://www.sgs.utoronto.ca/Documents/EssentialGuideforGrads.pdf>

#### **4.13 SGS forms**

Most forms used by SGS/Graduate Office can be found here:

<http://www.sgs.utoronto.ca/currentstudents/Pages/Student-Forms-and-Letters.aspx>



# Appendix A

## Sample MEng Curriculum paths

\* These paths are only a guideline

\* Not all the courses listed below are offered on annual basis. Please confirm with the appropriate department.

	<b>Pillars</b>	<b>Neural/Sensory Systems Rehabilitation Neural/Sensory Systems Rehabilitation</b>	<b>Biomaterials, Tissue Engineering and Regenerative Medicine</b>	<b>Nanotechnology, Molecular Imaging and Systems Biology</b>	<b>Engineering in a Clinical Setting</b>
<i>Fall</i>	<b>Biomedical Engineering</b>	BME1473: Acquisition and Processing of Bioelectric Signals	BME1480: Experimental Design and Multivariate Analysis	ECE1475: Bio-Photonics	BME1405: CE Instrumentation I
	<b>Commercialization and</b>	BME1800	BME1800	BME1800	BME1800
	<b>Biomedical Science</b>	JBP1022: Human Physiology as Related to Engineering	MSC7000Y: Regenerative Medicine	BME1459: Protein Engineering	JNS1000Y: Fundamentals of Neuroscience: Systems and Behavior
<i>Winter</i>	<b>Biomedical Engineering</b>	JEB1444: Neural Engineering REH1510: Disordered and Restorative Motor Control	JMB1050: Biological and Bio-Inspired Materials MSC7000Y: Regenerative Medicine or BME1460: Quantitative Fluorescence Microscopy	BME1462: Biological Image Analysis or MSE1036: Optical and Photonic Materials BME1460: Quantitative Fluorescence Microscopy	BME1439: CE Instrumentation II or JEB1433: Medical Imaging JNS1000Y: Fundamentals of Neuroscience: Systems and Behavior
	<b>Commercialization</b>	BME1801 APS1001: Project Management	BME1801 APS1020: International Business for Engineers	BME1801 APS1420: Technology, Engineering and Global Development	BME1801 LAW6039: Looking Ahead: The Blurred Lines of Technology, Body and Mind
<i>Summer</i>	<b>Practical Experience</b>	BME1899	BME1899	BME1899	BME1899

	<b>Pillars</b>	<b>Neural/Sensory Systems Rehabilitation Neural/Sensory Systems Rehabilitation</b>	<b>Biomaterials, Tissue Engineering and Regenerative Medicine</b>	<b>Nanotechnology, Molecular Imaging and Systems Biology</b>	<b>Engineering in a Clinical Setting</b>
<i>Fall</i>	<b>Biomedical Engineering</b>	BME1471: Rehabilitation Engineering or ECE1774: Sensory Cybernetics	JTC1331: Biomaterials Science	BME1457: Biomedical Nanotechnology	BME1452: Signal Processing
	<b>Commercialization</b>	BME1800	BME1800	BME1800	BME1800
	<b>Biomedical Engineering</b>	MSC3001: The Foundations in Musculoskeletal Science	BME1454: Regenerative Medicine: Fundamentals and Applications	BME1459: Protein Engineering	JNS1000Y: Fundamentals of Neuroscience: Systems and Behavior
<i>Winter</i>	<b>Biomedical Engineering</b>	BME1472: Fund. of Neuromodulation Tech and Clinical App. JEB1444: Neural Engineering Or REH1510: Disordered and Restorative Motor Control	JMB1050: Biological and Bio-Inspired Materials  BME1460: Quantitative Fluorescence Microscopy or PSL1462: Molecular Aspects of Cardiovascular Function	BME1462: Biological Image Analysis JCB1349: Molecular Assemblies, Structure/Function/Prop. or BME1460: Quantitative Fluorescence Microscopy	JEB1433: Medical Imaging JNS1000Y: Fundamentals of Neuroscience: Systems and Behavior
	<b>Commercialization</b>	BME1801	BME1801 APS1027: Engineering Presentations	BME1801 APS1036: Formative, Experiential Entrepreneurial Learning	BME1801 APS1027: Engineering Presentations
<i>Summer</i>	<b>Practical Experience</b>	BME1899	BME1899	BME1899	BME1899

# Appendix B

The courses listed in Appendix B are 0.5 FCE (i.e. one semester course) unless indicated otherwise i.e. Y after the course code which indicates 1.0 FCE either covering 2 semesters or condensed in one semester.

## Biomedical Engineering Courses

Most of these courses are relevant to two of more fields. They were classified in one specific field for convenience only.

### Examples of courses related to Molecular Engineering Imaging & Systems Biology

- BME 1642—Biological Image Analysis
- BME 1457—Biomedical Nanotechnology
- JEB 1433—Medical Imaging
- BME 1459—Protein Engineering
- BME 1460—Quantitative Fluorescence Microscopy
- JCB 1349—Molecular Assemblies: Structure, Function & Properties

### Examples of courses related to Tissue Engineering

- BME 1480—Experimental Design & Multivariate Analysis
- JMB 1050—Biological & Bio-Inspired Materials
- JTC 1331—Biomaterials Science
- BME 1454—Regenerative Medicine: Fundamentals & Applications
- BME 1460—Quantitative Fluorescence Microscopy
- ☐ JBP1022: Human Physiology as Related to Engineering

### Examples of courses related to clinical Engineering

- BME 1405—Clinical Engineering Instrumentation I
- BME 1439—Clinical Engineering Instrumentation II
- BME 1452—Signal Processing
- JEB 1365—Ultrasound: Theory & Application
- JEB 1433—Medical Imaging
- BME 1471—Rehabilitation Engineering
- BME 1472—Fundamentals of Neuromodulation Technology & Clinical Application
- BME 1473—Acquisition & Processing of Bioelectric Signals
- JEB 1444—Neural Engineering
- ☐ JBP1022: Human Physiology as Related to Engineering

### Examples of Partner Department Courses (Registration is subject to approval by Program Director and Department offering the course)

- ☐ DEN1070H - Advances in Dental Materials Science
- ☐ DEN1081H - Bone Interfacing Implants
- ☐ JTC1331F - Biomaterials Science

- ☐ ECE1475H - Bio Photonics
- ☐ CHE575H1F - Mechanical Properties of Biocomposites and Biomaterials
- ☐ CHE562F - Chemical Properties of Polymers
- ☐ ECE557F - Systems Control
- ☐ MIE520H1F - Biotransport Phenomena
- ☐ MSE550 - Advanced Physical Properties of Structural Nanomaterials
- ☐ MIE1359H: Engineering Cell Biology and Micro/Nanoengineered Platforms
- ☐ MIE505H1: Micro/Nano Robotics
- ☐ MIE506H1: MEMS Design and Microfabrication
- ☐ MSE1036: Optical and Photonic Materials
- ☐ ECE1774: Sensory Cybernetics
- REH 1510—Disordered & Restorative Motor Control
- ☐ PSL1462: Molecular Aspects of Cardiovascular Function
- MSC 3001—Foundations in Musculoskeletal Science
- PSL 1462—Molecular Aspects of Cardiovascular Function
- JNS 1000Y—Fundamentals of Neuroscience: Systems & Behaviour (2 semester)
- DEN 1060H—Oral Physiology: Sensory and Neuromuscular Function
- MSC2012Y — Neuroanatomy for Visual Communication (artwork) ((1.0 FCE condensed in winter session)s

For updated list and schedule for mechanical and industrial engineering (MIE) course, go to

<https://www.mie.utoronto.ca/graduate/courses/>

For updated list and schedule for electrical and computer engineering (ECE) course, go to

<https://www.ece.utoronto.ca/graduates/courses/timetable/>

For updated list and schedule for chemical engineering (CHE) course, go to

<http://www.chem-eng.utoronto.ca/graduate-studies/programs-degrees/graduate-courses/course-details/>

For updated list and schedule for materials science & engineering (MSE) course, go to

<http://mse.utoronto.ca/current/graduate/courses-fall/>

<http://mse.utoronto.ca/current/graduate/courses-winter/>

For updated list and schedule for Computer Science (CSC) courses, go to

<http://web.cs.toronto.edu/Graduate/currentgradstudents/gradprogram.htm>

Occasionally, courses may be found in the list of other departments and collaborative programs (**registration in these course is subject to approval by Program Director and Department offering the course since there are often restrictions**). Here are a few examples:

Collaborative Program in Neuroscience

[http://www.neuroscience.utoronto.ca/students/Grad\\_Courses.htm](http://www.neuroscience.utoronto.ca/students/Grad_Courses.htm)

Collaborative Program in Cardiovascular Sciences

<http://www.cscp.utoronto.ca/program/courses/>

Institute of Medical Science:

<https://ims.utoronto.ca/courses/timetables/>

Laboratory Medicine and Pathology:

<http://www.lmp.utoronto.ca/graduate/courses-graduate>

Immunology:

<http://immunology.utoronto.ca/msc-coursework-program-applied-immunology>

## **Commercialization and Entrepreneurship Courses**

- BME 1800—Biomedical Product Development I (*required core course*)
- BME 1801—Biomedical Product Development II
- BME 1405—Clinical Engineering Instrumentation I
- BME 1802—Biomedical Devices – Human Factors
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### **Examples of partner Department Courses (Registration is subject to approval by Program Director and Department offering the course)**

- ☐ APS 1001: Project Management
- ☐ APS 1005: Operations Research for Engineering Management
- ☐ APS 1010: Cognitive and Psychological Foundations of Effective Leadership
- ☐ APS 1012: Management of Innovation in Engineering
- ☐ APS 1015: Social Entrepreneurship
- ☐ APS 1016: Financial Management for Engineers
- ☐ APS 1017: Supply Chain Management and Logistics
- ☐ APS1020: International Business for Engineers
- ☐ APS1027: Engineering Presentations
- ☐ APS1036: Formative, Experiential, Entrepreneurial Learning
- ☐ APS 1088: Entrepreneurship and Business for Engineers
- ☐ APS 1201: Topics in Engineering and Public Policy
- ☐ APS 1202: Engineering and Sustainable Development
- ☐ APS1420: Technology, Engineering and Global Development
- ☐ MIE1501: Knowledge Modelling and Management
- ☐ MIE1402: Experimental Methods in Human Factors Research
- ☐ MIE1407: Engineering Psychology and Human Performance
- ☐ LAW524/BTC2110H: Patent Law for the Life sciences
- ☐ LAW6039: Looking Ahead: The Blurred Lines of Technology, Body and Mind
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**The list of APS courses offered and schedule can be found here**

<http://gradstudies.engineering.utoronto.ca/professional-degrees/elite-certificate/>