

## Bioengineering Curriculum - Stream 2 (Biomolecular & Cellular Engineering)

2020 cohort

Non-CEGEP Entry

1st Semester (Fall)		15 credits	Prerequisites/Co-requisites
CHEM 110	<a href="#">General Chemistry 1</a>	4	-
FACC 100	<a href="#">Introduction to the Engineering Profession</a>	1	-
MATH 133	<a href="#">Linear Algebra and Geometry</a>	3	-
MATH 140	<a href="#">Calculus 1</a>	3	-
PHYS 131	<a href="#">Mechanics and Waves</a>	4	C - MATH 140
2nd Semester (Winter)		18 credits	Prerequisites/Co-requisites
BIOL 112	<a href="#">Cell and Molecular Biology</a>	3	-
CHEM 120	<a href="#">General Chemistry 2</a>	4	-
CS	Complementary Studies - Group B (HSSML)	3	-
MATH 141	<a href="#">Calculus 2</a>	4	P - MATH 140
PHYS 142	<a href="#">Electromagnetism and Optics</a>	4	P - PHYS 131 / C - MATH 141
3rd Semester (Fall)		14 credits	Prerequisites/Co-requisites
BIEN 200	<a href="#">Introduction to Bioengineering</a>	2	P - Permission of Instructor
CHEM 212	<a href="#">Introductory Organic Chemistry 1</a>	4	P - CHEM 110 / C - CHEM 120
MATH 262	<a href="#">Intermediate Calculus</a>	3	P - MATH 141, MATH 133
MATH 263	<a href="#">Ordinary Differential Equations for Engineers</a>	3	C - MATH 262
MECH 210	<a href="#">Mechanics 1</a>	2	P - PHYS 101 or PHYS 131
4th Semester (Winter)		12 credits	Prerequisites/Co-requisites
BIEN 210	<a href="#">Electrical and Optical Properties of Biological Systems</a>	3	P - BIEN 200/C - BIOL 112 or Permission of Instructor
BIEN 300	<a href="#">Thermodynamics in Bioengineering</a>	3	P - CHEM 120, MATH 203, PHYS 142
COMP 208	<a href="#">Computers in Engineering</a>	3	P - MATH 140, MATH 141
FACC 250	<a href="#">Responsibilities of the Professional Engineer</a>	0	P - FACC 100 or BREE 250
MATH 203	<a href="#">Principles of Statistics 1</a>	3	-
5th Semester (Fall)		17 credits	Prerequisites/Co-requisites
BIEN 219	<a href="#">Introduction to Physical Biology of the Cell</a>	4	P - BIOL 112 / C - CHEM212
BIEN 290	<a href="#">Bioengineering Measurement Laboratory</a>	3	P - BIEN 200, MATH 203, PHYS 142
BIEN 310	<a href="#">Introduction to Biomolecular Engineering (TC STREAM 2 List A)</a>	3	P - BIEN 200 or Permission of Instructor
BIEN 350	<a href="#">Biosignals, Systems and Control</a>	4	P - MATH 263 or Permission of Instructor
MATH 264	<a href="#">Advanced Calculus for Engineers</a>	3	P - MATH 262 or MATH 151 or MATH 152 / C - MATH 263
6th Semester (Winter)		15 credits	Prerequisites/Co-requisites
BIEN 320	<a href="#">LiMolecular, Cellular and Tissue Biomechanics (TC STREAM 2 List A)</a>	3	P - BIOL 112 and MECH 210
BIEN 360	<a href="#">Physical Chemistry in Bioengineering</a>	3	P - BIEN 300
BIEN 390	<a href="#">Bioengineering Laboratory</a>	3	P - BIEN 290
CCOM 206	<a href="#">Communication in Engineering</a>	3	-
FACC 300	<a href="#">Engineering Economy</a>	3	-
7th Semester (Fall)		12 credits	Prerequisites/Co-requisites
BIEN 314	<a href="#">Transport Phenomena in Biological Systems 1</a>	3	P - BIEN 200, MATH 263, BIEN 300 or permission of instructor
CIVE 281	<a href="#">Analytical Mechanics</a>	3	C - MATH 262, MATH 263
CS	Complementary Studies - Group B (HSSML)	3	-
TC Stream 2 List B	Stream 2 Technical Complementary from List B	3	-
8th Semester (Winter)		12 credits	Prerequisites/Co-requisites
BIEN 340	<a href="#">Transport Phenomena in Biological Systems 2</a>	3	P - BIEN 314, BIEN 360 or permission of instructor
BIEN 590	<a href="#">Cell Culture Engineering (TC STREAM 2 List A)</a>	3	P - Permission of Instructor
PHYS 319	<a href="#">Introduction to Biophysics</a>	3	P - BIOL 200; MATH 222/MATH 262; PHYS 230 and (PHYS 232 or PHYS 253), or Permission of Instructor
TC Stream 2 List B	Stream 2 Technical Complementary from List B	3	-
9th Semester (Fall)		15 credits	Prerequisites/Co-requisites
BIEN 420	<a href="#">Design of Diagnostic Biodevices</a>	3	P - BIEN 340, BIEN 390
BIEN 470 D1	<a href="#">Bioengineering Design Project</a>	3	P - Permission of Instructor, U4
BIEN 550	<a href="#">Biomolecular Devices (TC STREAM 2 List A)</a>	3	P - Permission of Instructor
BIEN 560	<a href="#">Design of Biosensors</a>	3	P - Permission of Instructor
TC Stream 2 List B	Stream 2 Technical Complementary from List B	3	-
10th Semester (Winter)		12 credits	Prerequisites/Co-requisites
BIEN 470 D2	<a href="#">Bioengineering Design Project</a>	3	P - Permission of Instructor, U4
BIEN 471	<a href="#">Bioengineering Research Project</a>	2	P - Permission of Instructor
CS	Complimentary Studies - Group A (Impact)	3	-
FACC 400	<a href="#">Engineering Professional Practice</a>	1	P - FACC 100, FACC 250, and 60 program credits
TC Stream 2 List B	Stream 2 Technical Complementary from List B	3	-
<b>TOTAL:</b>		<b>142</b>	

\*The Complementary Studies (CS) courses are Impact of Technology courses (Group A) and Humanities & Social Sciences, Management Studies and Law courses (Group B). Students must take one course (3 credits) from Group A and one course (3 credits) from Group B. The curriculum above includes suggested terms during which these courses can be taken. These must be chosen from an approved list of courses/departments, found in the program list under "Complementary Studies" in the Faculty of Engineering Undergraduate section of the Programs, Courses and University Regulations publication ([www.mcgill.ca/study](http://www.mcgill.ca/study)) (see your program listing in the "Browse Academic Units & Programs" section).

Students are responsible for satisfying pre/co-requisites and verifying with their department that they are meeting the requirements of their program.

## Engineering Science and Design Technical Complementaries (List B)

Starting in the third year (second year for CEGEP students) (Year 2/U2), students will need to take 24-25 credits of Technical Complementary courses to upgrade their general knowledge of Bioengineering. Students must register for the required Technical Complementary courses in one of the three streams of bioengineering knowledge and practice: 1) Biological Materials and Mechanics (25 credits); **2) Biomolecular and Cellular Engineering (24 credits)**; or 3) Biological Information and Computation (24-25 credits).

### The courses listed below may be taken as List B Technical Complementaries in STREAM 2

Select 4 List B TCs (12 credits)			
Course number	Course name	Credits	Prerequisites/Co-requisites
BIEN 330	Tissue Engineering and Regenerative Medicine	3	P - BIEN 200, BIOL 112, BIOL 200, and CHEM 212, or instructor permission
BIEN 410	Computational Methods in Biomolecular Engineering	3	P - BIEN 310 and COMP 208, or instructor permission
BIEN 462	Engineering Principles in Physiological Systems	3	P - BIEN 350 or permission of instructor
BIEN 500	Special Topics in Bioengineering	3	P - Permission of Instructor, Not open to students who took MECH 500 (W2020)
BIEN 510	Engineered Nanomaterials for Biomedical Applications	3	P - BIEN 200, CHEM 212, and BIOL 112, or instructor permission
BIEN 530	Imaging and Bioanalytical Instrumentation	3	P - Permission of instructor
BIEN 535	Electron microscopy and 3D imaging for biological materials	3	P - Permission of instructor
BIEN 540	Information storage and processing in biological systems	3	P - Permission of instructor
BIEN 545	Medical diagnostics at the point of care	3	P - Permission of instructor
BIEN 570	Active Mechanics in Biology	3	P - Permission of instructor
BIEN 580	Synthetic Biology	3	P - Permission of instructor
BIEN 595	Advanced Biomolecular Systems Modeling	3	P - BIEN 410 and COMP 208, or permission of instructor
BMDE 503	Biomedical Instrumentation	3	P - Experience with differential equations, in particular Laplace Transforms and complex numbers (e.g. MATH 263 or MATH 381 or equivalent) or permission of instructor
BMDE 508	Intro to Micro and Nano Bioengineering	3	P - Permission of instructor
CIVE 557	Microbiology for Environmental Engineering	3	P - CIVE 225 or permission of the instructor
PHYS 534	Nanoscience and Nanotechnology	3	P - U3 or permission of instructor
SEAD 510*	Energy Analysis	4	P - Permission of instructor
SEAD 515	Climate Change Adaptation and Engineering Infrastructure	3	P - Permission of instructor
SEAD 520	Life Cycle-Based Environmental Footprinting	3	P - Permission of instructor
SEAD 530	Economics for Sustainability in Engineering and Design	3	P - Permission of instructor
SEAD 540	Industrial Ecology and Systems	3	P - Permission of instructor
SEAD 550	Decision-Making for Sustainability in Engineering and Design	3	P - Permission of instructor

**NOTE: Maximum of two SEAD courses are allowed.**