

# Bioengineering Curriculum - Fall 2020

## Stream 2 - Biomolecular and Cellular Engineering

CEGEP Entry

1st Term (Fall)		14 credits	Prerequisites/Co-requisites
BIEN 200	Introduction to Bioengineering	2	-
CHEM 212	Introductory Organic Chemistry 1	4	P - CHEM 110 / C - CHEM 120
MATH 262	Intermediate Calculus	3	P - MATH 133, MATH 141
MATH 263	Ordinary Differential Equations for Engineers	3	C - MATH 262
MECH 210	Mechanics 1	2	P - PHYS 101 or PHYS 131 or equivalent
2nd Term (Winter)		16 credits	Prerequisites/Co-requisites
BIEN 210	Electrical and Optical Properties of Biological Systems	3	P - BIEN 200 / C - BIOL 112
BIEN 300	Thermodynamics in Bioengineering	3	P - CHEM 120, MATH 262
BIOL 112	Cell and Molecular Biology	3	-
COMP 208	Computers in Engineering	3	P - MATH 141 / C - MATH 133
FACC 100	Introduction to the Engineering Profession	1	-
MATH 203	Principles of Statistics 1	3	-
3rd Term (Fall)		17 credits	Prerequisites/Co-requisites
BIEN 219	Introduction to Physical Biology of the Cell	4	P - BIOL 112 / C - CHEM 212
BIEN 290	Bioengineering Measurement Laboratory	3	P - BIEN 200, MATH 203, PHYS 142
BIEN 310	Introduction to Biomolecular Engineering (TC Stream 2 List A)	3	P - BIEN 200 or permission of instructor
BIEN 350	Biosignals, Systems and Control	4	P - MATH 263 or permission of instructor
MATH 264	Advanced Calculus for Engineers	3	P - MATH 262 or MATH 151 or MATH 152 / C - MATH 263
4th Term (Winter)		15 credits	Prerequisites/Co-requisites
BIEN 320	Molecular, Cellular and Tissue Biomechanics (TC Stream 2 List A)	3	P - BIOL 112, MECH 210
BIEN 360	Physical Chemistry in Bioengineering	3	P - BIEN 300
BIEN 390	Bioengineering Laboratory	3	P - BIEN 290
CS	Complimentary Studies - Group B (HSSML)	3	-
FACC 250	Responsibilities of the Professional Engineer	0	P - FACC 100 or BREE 250
FACC 300	Engineering Economy	3	-
5th Term (Fall)		15 credits	Prerequisites/Co-requisites
BIEN 314	Transport Processes in Biological Systems 1	3	P - BIEN 200, MATH 263, BIEN 300 or permission of instructor
CCOM 206	Communication in Engineering	3	-
CIVE 281	Analytical Mechanics	3	C - MATH 262, MATH 263
EC	Elective - 1	3	-
TC Stream 2	Stream 2 Technical Complementary from List B	3	-
6th Term (Winter)		15 credits	Prerequisites/Co-requisites
BIEN 340	Transport Phenomena in Biological Systems 2	3	P - BIEN 314, BIEN 360 or permission of instructor
BIEN 590	Cell Culture Engineering (TC Stream 2 List A)	3	P - Permission of instructor
CS	Complementary Studies Group A (Impact)	3	-
PHYS 319	Introduction to Biophysics	3	P - BIOL 200, MATH 222 / MATH 262, PHYS 230 and (PHYS 232 or PHYS 253), or permission of instructor
TC Stream 2	Stream 2 Technical Complementary from List B	3	-
7th Term (Fall)		15 credits	Prerequisites/Co-requisites
BIEN 420	Design of Biodevices for Diagnostics and Screening	3	P - BIEN 340, BIEN 390
BIEN 470D1	Bioengineering Design Project	3	P - BIEN 390
BIEN 550	Biomolecular Devices (TC Stream 2 List A)	3	P - Permission of instructor
BIEN 560	Design of Biosensors	3	P - Permission of instructor
TC Stream 2	Stream 2 Technical Complementary from List B	3	-
8th Term (Winter)		15 credits	Prerequisites/Co-requisites
BIEN 470D2	Bioengineering Design Project	3	P - BIEN 390
BIEN 471	Bioengineering Research Project	2	P - Permission of instructor
EC	Elective - 2	3	-
EC	Elective - 3	3	-
FACC 400	Engineering Professional Practice	1	P - FACC 100, FACC 250, and 60 program credits
TC Stream 2	Stream 2 Technical Complementary from List B	3	-

122 Credits

\*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).

\*\*FACC 250 is not yet indicated as a prerequisite in the eCalendar course information ([www.mcgill.ca/study](http://www.mcgill.ca/study)) but it will be before FACC 400 is taken.

Elective courses (EC) can be chosen from any course at the 200-level or higher offered by the University, subject to permission of the offering department.

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

Starting in the third year (second year for CEGEP students) (Year 2), students will need to take 24-25 credits of 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).

## 24-25 credits from the following:

Course number	Course name	Credits	Prerequisites/Co-requisites
BIEN 267	Bioanalytical Methods in Bioengineering	3	P - CHEM 100, CHEM 120, and BIEN 200
BIEN 310	Introduction to Biomolecular Bioengineering	3	P - BIEN 200 or permission of instructor
BIEN 320	Molecular, Cellular, and Tissue Biomechanics	3	P - BIOL 112, MECH 210
BIEN 330	Tissue Engineering and Regenerative Medicine	3	P - BIEN 200, BIOL 112, BIOL 200, and CHEM 212, or instructor permission
BIEN 370	Introduction to Metabolic Engineering	3	P - BIEN 210
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 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 540	Information storage and processing in biological systems	3	
BIEN 550	Biomolecular Devices	3	P - Permission of instructor
BIEN 560	Design of Biosensors	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 590	Cell Culture Engineering	3	P - 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 504	Biomaterials and Bioperformance	3	P - U4 students only
BMDE 505	Cell and Tissue Engineering	3	P - U4 students only
BMDE 508	Intro to Micro and Nano Bioengineering	3	P - Permission of instructor
BMDE 512	Finite Element Modelling	3	P - Differential equations (MATH 271 or equivalent) or permission of instructor
BMDE 519	Biomedical Signals and Systems	3	P - Permission of Instructor
CHEE 563	Biofluids and Cardiovascular Mechanics	3	
or MECH 563	Biofluids and Cardiovascular Mechanics	3	P - CHEE 314 or MECH 331 or instructor permission
CIVE 207	Solid Mechanics	4	P - CIVE 205 or MECH 210
CIVE 557	Microbiology for Environmental Engineering	3	P - CIVE 225 or permission of the instructor
COMP 250	Introduction to Computer Science	3	P - Familiarity with a high level programming language and CEGEP level Math.
COMP 251	Algorithms and Data Structures	3	P - COMP 250
COMP 462	Computational Biology Methods	3	P - COMP 251, and MATH 323 or MATH 203 or BIOL 309
COMP 551	Applied Machine Learning	4	P - MATH 323 or ECSE 205 or ECSE 305 or equivalent
ECSE 415	Introduction to Computer Vision	3	P - ECSE 304 or ECSE 306 or ECSE 206
MATH 240	Discrete Structures 1	3	P - Permission of Instructor
MECH 547	Mechanics of Biological Materials	3	P - MECH 210 and MIME 260 / 261, or instructor permission
MIME 261	Structure of Materials	3	
MIME 470	Engineering Biomaterials	3	P - MIME 261 or permission of instructor
MIME 473	Introduction to Computational Materials Design	3	P - MIME 209 and MIME 261, or permission of instructor.
PHYS 534	Nanoscience and Nanotechnology	3	P - U3 or permission of instructor

## Last update: March 10, 2020

For the official program listing, see the *Programs, Courses and University Regulations* publication ([www.mcgill.ca/study](http://www.mcgill.ca/study)).