Bioengineering Curriculum - Stream 3 (Biological Information and Computation)

2022 cohort **CEGEP Entry**

1st Semester (Fall)		14 credits	Prerequisites/Co-requisites
BIEN 200	Introduction to Bioengineering	2	P - Permission of Instructor
CHEM 212	Introductory Organic Chemistry 1	4	P - CHEM 110 / C - CHEM 120
MATH 262	Intermediate Calculus	3	P - MATH 141, MATH 133
MATH 263	Ordinary Differential Equations for Engineers	3	C - MATH 262
MECH 210	Mechanics 1	2	-
2nd Semester (Winter)		16 credits	Prerequisites/Co-requisites
BIEN 210	Electrical and Optical Properties of Biological Systems	3	P - BIEN 200/ C - BIOL 112 or Permission of Instructor
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 140, MATH 141
FACC 100	Introduction to the Engineering Profession	1	-
MATH 203	Principles of Statistics 1	3	-
3rd Semester (Fall)		17 credits	Prerequisites/Co-requisites
BIEN 219	Introduction to Physical Biology of the Cell	4	P - BIOL 112 / C - CHEM212
BIEN 290	Bioengineering Measurement Laboratory	3	P - BIEN 200, MATH 203, PHYS 142
BIEN 310	Introduction to Biomolecular Engineering (TC STREAM 3 List A)	3	P - BIEN 200 or Permission of Instructor
BIEN 350	Biosignals, Systems and Control	4	P - MATH 263 or Permission of Instructor
TC Stream 3 List B	Stream 3 Technical Complementary from List B	3	
4th Semester (Winter)		15 credits	Prerequisites/Co-requisites
BIEN 360	Physical Chemistry in Bioengineering	3	P - BIEN 300
BIEN 390	Bioengineering Laboratory	3	P - BIEN 290
CS	Complementary Studies - Group B (HSSML)	3	-
FACC 250	Responsibilities of the Professional Engineer	0	P - FACC 100 or BREE 250
FACC 300	Engineering Economy	3	-
MATH 264	Advanced Calculus for Engineers	3	P - MATH 262 or MATH 151 or MATH 152/ C - MATH 263
5th Semester (Fall)		15 credits	Prerequisites/Co-requisites
BIEN 314	Transport Phenomena in Biological Systems 1	3	P - BIEN 200, MATH 263, BIEN 300 or permission of instructor
BIEN 410	Computational Methods in Biomolecular Engineering (TC STREAM 3 List A)	3	P - BIEN 310 and COMP 208 or Permission of Instructor
BIEN 267	Bioanalytical Methods in Bioenginering	3	P - BIEN 290
EC	Elective - 1	3	-
TC Stream 3 List B	Stream 3 Technical Complementary from List B	3	
6th Semester (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 530	Imaging and Bioanalytical Instrumentation (TC STREAM 3 List A)	3	P - Permission of Instructor
WCOM 206	Communication in Engineering	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 3 List B	Stream 3 Technical Complementary from List B	3	
7th Semester (Fall)		15 credits	Prerequisites/Co-requisites
BIEN 420	Design of Diagnostic Biodevices	3	P - BIEN 340, BIEN 390
BIEN 470 D1	Bioengineering Design Project	3	P - Permission of Instructor, U4
BIEN 560	Design of Biosensors	3	P - Permission of Instructor
EC	Elective - 2	3	-
TC Stream 3 List B	Stream 3 Technical Complementary from List B	3	
8th Semester (Winter)		15 credits	Prerequisites/Co-requisites
BIEN 470 D2	Bioengineering Design Project	3	P - Permission of Instructor, U4
BIEN 471	Bioengineering Research Project	2	P - Permission of Instructor
BIEN 540	Information Storage and Processing in Biological Systems (TC STREAM 3 List A)	3	P - Permission of Instructor
CS	Complementary Studies - Group A (Impact)	3	-
EC	Elective - 3	3	-
FACC 400	Engineering Professional Practice	1	P - FACC 100, FACC 250, and 60 program credits
	TOTAL:	**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 nd 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) (see your program listing in the "Browse Academic Units & Programs" section).

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/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 credits)**.

The courses listed below may be taken as List B Technical Complementaries in STREAM 3

Select 4 List B TCs (12 credits)

Course number	Course name	Credits	Prerequisites/Co-requisites
BIEN 414	Fundamentals and Rheology of Biological Fluids	3	P - MATH 262 and BIEN 314, or permission of the instructor
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 535	Electron microscopy and 3D imaging for biological materials	3	P - Permission of instructor
BIEN 545	Medical diagnostics at the point of care	3	P - Permission of instructor
BIEN 580	Synthetic Biology	3	P - Permission of instructor
BIEN 585	Metabolic Engineering	3	P - Permission of instructor
BIEN 595	Advanced Biomolecular Systems Modeling	3	P - BIEN 410 and COMP 208, or permission of instructor
BMDE 502	Biological Modeling and Identification	3	Undergraduate basic statistics and: either BMDE 519, or Signals and Systems (e.g., ECSE 303 & ECSE 304) or equivalent
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 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
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 513	Control Systems	3	P - BIEN 350 and permission of instructor
MECH 572	Mechanics and Control of Robotic Manipulators	3	P - 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: Students in Stream 3 may only take <u>one</u> of the two 4 credit list B TCs (either COMP 551 or SEAD 510 or another 3 credit list B TC)**
If you take a 4 credit List B TC, you will graduate with 123 credits
NOTE: Maximum of two SEAD courses are allowed.