McGill

Report of the
Academic Policy Committee D14-02

457th REPORT OF THE ACADEMIC POLICY COMMITTEE TO SENATE
On APC meeting held on May 15th 2014

I. TO BE APPROVED BY SENATE

(A) NEW TEACHING PROGRAMS REQUIRING SENATE APPROVAL (approvals of new minors and options added to existing programs and major revisions to programs are reported in Section IV.A.1.a. for information)

Faculty of Engineering

- B.Eng; Bioengineering (141-151 cr.) – *Appendix A*

At a meeting on 15th May 2014, APC reviewed and approved a proposal from the Faculty of Engineering to create a Bachelor of Engineering, major in Bioengineering. Bioengineering is a rapidly emerging field with considerable commercial and societal value. It was listed in McGill's 2008 strategic plan as an existing area of strength and of current and future investment within McGill. The demand is growing for highly qualified personnel, notably in Quebec, which has the fourth highest number of biotechnology companies of any province or state in North America. Currently, there is a limited access to training in bioengineering for undergraduates in the Faculty of Engineering, primarily through the minor in Biomedical Engineering. Undergraduate students can also enroll in the Bioresource Engineering program, which has a focus on Agricultural and Environmental Engineering. The only program in Biomedical Engineering currently available at McGill is offered by the Faculty of Medicine at the graduate level. There is a clear need for an undergraduate degree program in engineering providing a fundamental training in the broad area of engineering in the life sciences. The proposed program will be complementary to the existing Bachelor of Engineering in Bioresource Engineering, and will provide a good background to those wishing to continue in Biomedical Engineering at the graduate level.
The goal of the proposed program is to provide undergraduate students with a solid training in the fundamentals of bioengineering and an exposure to specialized topics in specific areas of Bioengineering whether they are health-care or non-health-care related. The style and workload of the proposed program will be similar to the ones in other Bachelors of Engineering offered by the Faculty of Engineering.

APC therefore recommends that Senate approve the following resolution:

Be it resolved that Senate approve the proposed B.Eng; Bioengineering (141-151 cr.)

(B) ACADEMIC PERFORMANCE ISSUES / POLICIES / GOVERNANCE/AWARDS - *none*

(C) CREATION OF NEW UNITS / NAME CHANGES / REPORTING CHANGES - *none*

(D) CHANGES IN DEGREE DESIGNATION - *none*

(E) INTER-UNIVERSITY PARTNERSHIPS – *none*

(F) OTHER – *none*

II. TO BE ENDORSED BY SENATE / PRESENTED TO SENATE FOR DISCUSSION – *none*

III. APPROVED BY APC IN THE NAME OF SENATE

(A) DEFINITIONS – *none*

(B) STUDENT EXCHANGE PARTNERSHIPS / CONTRACTS / INTERUNIVERSITY PARTNERSHIPS - *none*

(C) OTHER - *none*

IV. FOR THE INFORMATION OF SENATE

A) ACADEMIC UNIT REVIEWS

In accordance with the policy on Academic Unit Reviews (approved by Senate on 19th Jan 2011), APC assessed, in 2013/2014, the documents pertaining to the reviews of the following academic units:
Department of Philosophy (Sept 19th, 2013)
Department of Anthropology (October 3rd, 2013)
Department of Translation and Written Communication (October 3rd, 2013)
Faculty of Religious Studies (October 31st, 2013)
School of Communication Sciences and Disorders (November 21st, 2013)
Department of Physics (November 21st, 2013)
Department of Integrated Studies in Education (November 21st, 2013)
Department of Pathology (December 12th, 2013)
Department of Earth and Planetary Science (February 6th, 2014)
Faculty of Dentistry (February 6th, 2014)
Institute of Parasitology (February 6th, 2014)
Department of Chemistry (February 6th, 2014)
Department of Psychiatry (March 20th, 2014)
Department of Economics (March 20th, 2014)
Department of Physiology (April 3rd, 2014)
Department of Psychology (April 3rd, 2014)
Institute of Gender, Sexuality and Feminist Studies (May 15th, 2014)
Medical Physics Unit (May 15th, 2014)

B) APPROVAL OF COURSES AND TEACHING PROGRAMS

1. Programs

a) APC approvals (new options/concentrations and major revisions to existing programs)

i. New concentrations/options within existing programs
Desautels Faculty of Management
Ph.D.; Management; Environment (0 cr.)
Across the University, number of Faculties and Departments are joining with the School of Environment to offer a new environment option as part of various existing degrees. This new environment option, available to students pursuing a Ph.D. in Management, will provide them with an appreciation of the role of science in informing decision-making in

the environment sector, and the influence that political, socio-economic and ethical judgments have.

Approved by CGPS March 17th, 2014; SCTP April 10th, 2014; and APC May 15th, 2014 (14-APC-05-82)

Faculty of Medicine
M.Sc.; Experimental Surgery; Surgical Education; Thesis (45 cr.)
This concentration responds to an increasing demand and interest for surgeons with expertise in Surgical Education, and provides the basic education coursework and research exposure for a candidate to obtain a solid foundation in Surgical Education.

M.Sc.; Experimental Surgery; Surgical Innovation; Thesis (45 cr.)
The aim of this concentration is to attract more residents and scientists into surgical research, by offering training that is likely going to be more relevant to them going forward. It allows for a hands-on learning experience for students to develop skills necessary to work within multi-disciplinary teams in the creation of a novel, needs-driven and marketable prototypes used in the development of novel surgical and medical devices.

Approved by CGPS March 17th, 2014; SCTP April 10th, 2014; and APC May 15th, 2014 (14-APC-05-82)

ii. Major revisions of existing programs

Faculty of Arts
B.A.; Liberal Arts; Major Concentration (36 cr.)
B.A.; Liberal Arts; Honours (60 cr.)
Both programs expose students to texts and histories of a suitably wide range of cultures and societies. Revisions were made to strengthen them and streamline their administration. The addition of new courses (a required introductory (LIBA 202) and capstone course (LIBA 402) to the B.A.; Liberal Arts; Major Concentration, and an introductory (LIBA 202) and a required Honours Thesis ((LIBA 490) to the B.A.; Liberal Arts; Honours Programs) requires students to complete a minor concentration in language program other than English, and also allowed the re-organization of the curriculum in three basic streams.

B.A.; World Islamic and Middle East Studies; Minor Concentration (18 cr.)
B.A.; World Islamic and Middle East Studies; Major Concentration (36 cr.)
B.A.; World Islamic and Middle East Studies; Honours (60 cr.)
B.A.; World Islamic and Middle East Studies Component; Joint Honours (36 cr.)
World Islamic and Middle East Studies is in an interdisciplinary program focusing on Muslim cultures and societies both past and present and aiming at providing students with training in the textual traditions and social life of Muslims across different times and places. The programs will be taking full advantage of the course offerings of the Institute of Islamic studies.

B.A.; Arabic Language, Minor Concentration (18 cr.)
B.A.; Persian Language, Minor Concentration (18 cr.)
B.A.; Turkish Language; Minor Concentration (18 cr.)
B.A.; Urdu Language; Minor Concentration (18 cr.)
These Minor Concentrations offer in depth training (listening, speaking, reading and writing) in Arabic, Persian, Turkish or Urdu.

Approved by SCTP April 10th, 2014 and APC May 15th, 2014 (14-APC-05-82)

Ph.D.; Sociology (0 cr.)
Ph.D.; Sociology; Gender and Women's Studies (0 cr.)
The Department of Sociology has been working on streamlining its program requirements to reflect the changing job market demands for sociology Ph.Ds. The language requirement, which does not provide significant added value to the students, has been suppressed for these two programs.

Approved by CGPS April 14th, 2014; SCTP April 30th, 2014 and APC May 15th, 2014 (14-APC-05-82)

Faculty of Medicine
M.Sc.; Experimental Surgery; Thesis (45 cr.)
The credit weight of this program was revised to meet the 45 credits requirement (reduction of the Thesis course by 3 credits), while still incorporating all required and complementary courses.

Approved by CGPS March 17th, 2014; SCTP April 10th, 2014; and APC May 15th, 2014 (14-APC-05-82)

Faculty of Science
M.Sc.; Computer Science; Thesis (45 cr.)
M.Sc.; Computer Science; Bioinformatics; Thesis (45 cr.)
M.Sc.; Computer Science; Computational Science and Engineering; Thesis (45 cr.)
The re-introduction of COMP 601 (Thesis Literature Review – 2 cr.) will ensure that students conduct a broad research review instead of focusing simply on their specific M.Sc. topic.

Approved by CGPS March 17th, 2014; SCTP April 10th, 2014; and APC May 15th, 2014 (14-APC-05-82)

b) APC Subcommittee on Courses and Teaching Programs (SCTP) approvals (Summary reports: http://www.mcgill.ca/sctp/documents/)

i. Moderate and minor program revisions
Faculty of Arts
Approved by SCTP February 2nd, 2014; reported to APC on May 15th, 2014 (14-APC-05-82)
B.A.; Classics; Honours (60 cr.)
B.A.; Langue et littérature françaises; Études et pratiques littéraires; Spécialisation (54 cr.)
B.A.; Langue et littérature françaises; Études et pratiques littéraires; Double spécialisation (36 cr.)
B.A.; Langues et littérature françaises; Études et pratiques littéraires; Concentration majeure (36 cr.)
B.A.; Langue et littérature françaises, Critique littéraires; Concentration mineure (18 cr.)
B.A.; Core Science Component in Physiology; Liberal Program (50 cr.)
B.A.; English; Drama and Theatre; major Concentration (36 cr.)
B.A.; English; Drama and Theatre; Honours (60 cr.)
B.A.; English; Drama and Theatre Component; Joint Honours (36 cr.)
M.A.; Linguistics; Non-Thesis (45 cr.)

Faculty of Dentistry

DMD (216 cr.)

Faculty of Engineering
B.Sc. (Architecture) (126 cr.)

Faculty of Science
Approved by SCTP on March 27th, 2014, reported to APC on May 15th, 2014 (14-APC-05-76)
B.Sc.; Biology; major (58-59 cr.)
B.Sc.; Physiology; Honours (75 cr.)
B.Sc.; Physiology; Major (64-65 cr.)
B.Sc.; Applied Mathematics; Honours (60 cr.)
B.Sc.; Mathematics; Honours (60 cr.)
B.Sc.; Mathematics and Physics; Honours (81 cr.)
B.Sc.; Probability and Statistics; Honours (65 cr.)
B.Sc.; Statistics and Computer Science; Honours (79 cr.)
B.Sc.; Mathematics and Computer Science; Joint Honours (75 cr.)

ii. Program retirements

Faculty of Arts
Approved by SCTP February 27th, 2014, reported to APC on May 15th, 2014 (14-APC-05-76)
B.A.; Liberal Arts Component; Joint honours (36 cr.)
Approved by SCTP April 10th, 2014; reported to APC May 15th, 2014 (14-APC-05-82)
B.A.; Middle East Studies; Major Concentration (36 cr.)
B.A.; Middle East Studies; Honours (60 cr.)
B.A.; Middle East Studies Component; Joint Honours (36 cr.)
B.A.; Middle East Studies; Minor Concentration (18 cr.)
B.A.; Middle East Languages; Minor Concentration (18 cr.)
B.A. Islamic Studies; Minor Concentration (18 cr.)

Faculty of Medicine
Approved by SCTP on January 16th, 2014, reported to APC on May 15th, 2014 (14-APC-05-76)
M.Sc. (applied); Nursing; Non-Thesis (45-58 cr.)

2. Courses

a) New Courses
Reported as having been approved by SCTP on December 5th, 2013
Faculty of Arts: 2
Faculty of Education: 3

Reported as having been approved by SCTP on March 13th, 2014
Faculty of Engineering: 9

Reported as having been approved by SCTP on March 27th, 2014
Faculty of Science: 3
Faculty of Medicine: 2
Reported as having been approved on April 10th, 2014
Faculty of Arts: 10
Faculty of Dentistry: 4

Faculty of Engineering: 3
Faculty of Medicine: 3
Schulich School of Music: 1

b) Course Revisions
Reported as having been approved by SCTP on December 5th, 2013
Faculty of Science: 3
Reported as having been approved on March 13th, 2014
Faculty of Science: 1
Reported as having been approved by SCTP on March 27th, 2014
Faculty of Medicine: 2
Faculty of Science: 8
Reported as having been approved by SCTP on April 10th, 2014
Faculty of Arts: 21
Faculty of Engineering: 10
Faculty of Medicine: 2
Schulich School of Music: 7

c) Course retirement
Reported as having been approved by SCTP on April 10th, 2014
Faculty of Arts: 24
Faculty of Engineering: 1
Faculty of Medicine: 1
Schulich School of Music: 1

(B) OTHER - *none*

McGill

New Program/Major or Minor/Concentration Proposal Form

(2013)

1.0 Degree Title
Please specify the two degrees for concurrent degree programs

B.Eng.

2.0 Administering Faculty/Unit

Faculty of Engineering

1.1 Major (Legacy= Subject)(30-char. max.)

Bioengineering

Offering Faculty/Department

Engineering / Department of Bioengineering

1.2 Concentration (Legacy = Concentration/Option)
If applicable to Majors only (30 char. max.)

3.0 Effective Term of Implementation
(Ex. Sept. 2004 = 200409)
Term

201509

1.3 Minor (with Concentration, if Applicable) (30 char. max.)

4.0 Rationale and Admission Requirements for New Proposal

See pages attached after Box 9.0 (P1-6 to P1-13).

5.0 Program Information
Please check appropriate box(es)

5.1 Program Type	5.2 Category	5.3 Level
X **Bachelor's Program**	Faculty Program (FP)	X **Undergraduate**
Master's	X **Major**	Dentistry/Law/Medicine
M.Sc. (Applied) Program	Joint Major	Continuing Studies (Non-Credit)
Dual Degree/Concurrent Program	Major Concentration (CON)	Collegial
Certificate	Minor	Masters & Grad Dips & Certs
Diploma	Minor Concentration (CON)	Doctorate
Graduate Certificate	Honours (HON)	Post-Graduate Medicine/Dentistry
Graduate Diploma	Joint Honours Component (HC)	Graduate Qualifying
Ph.D. Program	Internship/Co-op	Postdoctoral Fellows
Doctorate Program	Thesis (T)	5.4 FQRSC (Research) Indicator (for GPS) Yes No
(Other than Ph.D.)	Non-Thesis (N)	
Private Program	Other	
Off-Campus Program	Please specify	
Distance Education Program		
(By Correspondence)		
Other (Please specify)		

6.0 Total Credits

141-151

7.0 Consultation with
Related Units Yes ☒ No
Financial Consult Yes **X** No
Attach list of consultations.

8.0 Program Description (Maximum 150 words)

The B.Eng.; Major in Bioengineering will i) provide students with the ability to apply systematic knowledge of biology, physical sciences and mathematics; and sound engineering foundations in order to solve problems of a biological nature; and ii) prepare students for the broad area of bioengineering, incorporating both biology-focused biological engineering and medicine-focused biomedical engineering.

Students will acquire fundamental knowledge in bioengineering-related natural sciences and mathematics, as well as in the foundations of general engineering and bioengineering. Students will also acquire knowledge in one *area of specialisation of bioengineering*: i) biological materials and biomechanics; ii) biomolecular and cellular engineering; or iii) biomedical, diagnostic and high throughput screening engineering.

9.0 List of proposed program for the New Program/Major or Minor/Concentration.

If new concentration (option) of existing Major/Minor (program), please attach a program layout (list of all courses) of existing Major/Minor.

Proposed program (list courses as follows: Subj Code/Crse Num, Title, Credit weight under the headings of: Required Courses, Complementary Courses, Elective Courses)

Bachelor of Engineering (B.Eng.); Major in Bioengineering (141-151 credits)
Program credit weight: 141-151credits
Program credit weight for Quebec CEGEP students: 121-122 credits
Program credit weight for out-of-province students: 141-142 credits

Required Year 0 (Freshman) Courses
29 credits
Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credits for Year 0 (Freshman) courses, except BIOL 112, and enter a 121- to 122-credit program. Students from Quebec CEGEPs who have successfully completed a course at CEGEP that is equivalent to BIOL 112 may obtain transfer credits for this course by passing the McGill Science Placement Exam for BIOL 112. For information on transfer credit for French Baccalaureate, International Baccalaureate exams, Advanced Placement exams, Advanced Levels and Science Placement Exams, see http://www.mcgill.ca/engineering/student/sao/newstudents and select your term of admission.

BIOL 112	(3)	Cell and Molecular Biology
CHEM 110	(4)	General Chemistry 1
CHEM 120	(4)	General Chemistry 2
MATH 133	(3)	Linear Algebra and Geometry
MATH 140	(3)	Calculus 1
MATH 141	(4)	Calculus 2
PHYS 131	(4)	Mechanics and Waves
PHYS 142	(4)	Electromagnetism and Optics

Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Non-Departmental Courses
44 credits

BIOC 212	(3)	Molecular Mechanisms of Cell Function
BIOL 200	(3)	Molecular Biology
BREE 301	(3)	Biothermodynamics
CCOM 206	(3)	Communication in Engineering
CHEE 310	(3)	Physical Chemistry for Engineers
CHEM 212	(4)	Introductory Organic Chemistry 1
CIVE 281	(3)	Analytical Mechanics
COMP 208	(3)	Computers in Engineering
FACC 100*	(1)	Introduction to the Engineering Profession
FACC 300	(3)	Engineering Economy
FACC 400	(1)	Engineering Professional Practice
MATH 262	(3)	Intermediate Calculus
MATH 263	(3)	Ordinary Differential Equations for Engineers
MATH 264	(3)	Advanced Calculus for Engineers
MECH 210	(2)	Mechanics 1
PHYS 319	(3)	Introduction to Biophysics

*Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Bioengineering Courses
23 credits

BIEN 200	(2)	Introduction to Bioengineering
BIEN 210	(3)	Electrical and Optical Properties of Biological Systems
BIEN 290	(4)	Bioengineering Measurement Laboratory
BIEN 340	(3)	Transport Processes in Biological Systems

Attach extra page(s) as needed

BIEN 390 (3) Bioengineering Laboratory
BIEN 470 (6) Bioengineering Design Project
BIEN 471 (2) Bioengineering Research Project

Bioengineering Complementary Courses (36-37 credits)
Starting in the third year (second year for CEGEP students) (Year 2), students will need to take 36 credits of courses to upgrade their general knowledge of Bioengineering. While it is not mandatory, it is highly recommended that the students choose all courses in one of the three streams of bioengineering knowledge and practice: (i) Biological Materials and Mechanics (37 credits); (ii) Biomolecular and Cellular Engineering (36 credits); or (iii) Biomedical, Diagnostics and High Throughput Screening Engineering (36 credits). However, students may satisfy the Bioengineering Complementary Courses requirement by taking a minimum of 30 credits from the Engineering Science and Design Complementaries course list and 6 credits of any other courses in the course lists below.

Engineering Science and Design Complementaries
30-37 credits from the following:
BIEN 310 (3) Introduction to Biomolecular Engineering
BIEN 320 (3) Molecular, Cellular, and Tissue Biomechanics
BIEN 330 (3) Introduction toTissue Engineering
BIEN 350 (3) Biosystems and Control
BIEN 462 (3) Engineering Principles in Physiological Systems
BIEN 510 (3) Applications of Nanoparticles in the Biomedical Sciences
BIEN 520 (3) High Throughput Bioanalytical Devices
BIEN 530 (3) Imaging and Bioanalytical Instrumentation
BIEN 550 (3) Biomolecular Devices
BIEN 560 (3) Biosensors
BIEN 570 (3) Active Mechanics in Biology
BMDE 504 (3) Biomaterials and Bioperformance
BMDE 505 (3) Cell and Tissue Engineering
BMDE 509 (3) Quantitative Analysis and Modelling of Cellular Processes
CHEE 314 (3) Fluid Mechanics
CHEE 370 (3) Elements of Biotechnology
CHEE 390 (3) Computational Methods in Chemical Engineering
CHEE 563 (3) Biofluids and Cardiovascular Mechanics
CIVE 207 (4) Solid Mechanics
CIVE 557 (3) Microbiology for Environmental Engineering
CIVE 558 (3) Biomolecular Techniques for Environmental Engineering
ECSE 529 (3) Computer and Biological Vision
MECH 502 (3) Topics in Mechanical Engineering**
MECH 547 (3) Mechanics of Biological Materials
MECH 553 (3) Design and Manufacture of Microdevices

*When topic is appropriate, as: Microfluidics and bioMEMs
Note: Students may choose only one of CHEE 563 and MECH 563 Biofluids and Cardiovascular Mechanics

0-6 credits from other courses listed in the streams below:

Stream 1: Biological Materials and Mechanics (37 credits)
BIEN 320 (3) Molecular, Cellular, and Tissue Biomechanics
BIEN 462 (3) Engineering Principles in Physiological Systems
BIEN 510 (3) Applications of Nanoparticles in the Biomedical Sciences
BIEN 570 (3) Active Mechanics in Biology
BMDE 504 (3) Biomaterials and Bioperformance
BMDE 505 (3) Cell and Tissue Engineering
CHEE 314 (3) Fluid Mechanics
CHEE 563 (3) Biofluids and Cardiovascular Mechanics
CIVE 207 (4) Solid Mechanics
MECH 547 (3) Mechanics of Biological Materials
MIME 261 (3) Structure of Materials
MIME 470 (3) Engineering Biomaterials
Note: Students may choose only one of CHEE 563 and MECH 563 Biofluids and Cardiovascular Mechanics

Stream 2: Biomolecular and Cellular Engineering (36 credits)
BIEN 310 (3) Introduction to Biomolecular Engineering
BIEN 320 (3) Molecular, Cellular, and Tissue Biomechanics
BIEN 330 (3) Introduction to Tissue Engineering
BIEN 550 (3) Biomolecular Devices
BIEN 570 (3) Active Mechanics in Biology
BIOC 311 (3) Metabolic Biochemistry

BMDE 509 (3) Quantitative Analysis and Modelling of Cellular Processes
CHEE 370 (3) Elements of Biotechnology
CHEE 390 (3) Computational Methods in Chemical Engineering
CIVE 557 (3) Microbiology for Environmental Engineering
CIVE 558 (3) Biomolecular Techniques for Environmental Engineering
PHYS 534 (3) Nanoscience and Nanotechnology

Stream 3: Biomedical, Diagnostics and High Throughput Screening Engineering (36 credits)
BIEN 350 (3) Biosystems and Control
BIEN 520 (3) High Throughput Bioanalytical Devices
BIEN 530 (3) Imaging and Bioanalytical Instrumentation
BIEN 560 (3) Biosensors
CHEE 314 (3) Fluid Mechanics
CHEM 287 (2) Introductory Analytical Chemistry
CHEM 297 (1) Introductory Analytical Chemistry Laboratory
CHEM 367 (3) Instrumental Analysis 1
CIVE 558 (3) Biomolecular Techniques for Environmental Engineering
ECSE 529 (3) Computer and Biological Vision
MECH 502 (3) Topics in Mechanical Engineering*
MECH 553 (3) Design and Manufacture of Microdevices
PHYS 534 (3) Nanoscience and Nanotechnology
*When topic is appropriate, as: Microfluidics and bioMEMs.

Complementary Studies
9 credits

Group A – Impact of Technology on Society
3 credits from the following:
ANTH 212 (3) Anthropology of Development
CIVE 469 (3) Infrastructure and Society
ECON 225 (3) Economics of the Environment
ECON 347 (3) Economics of Climate Change
ENVR 201 (3) Society, Environment and Sustainability
GEOG 200 (3) Geographical Perspectives: World Environmental Problems
GEOG 203 (3) Environmental Systems
GEOG 205 (3) Global Change: Past, Present and Future
GEOG 302 (3) Environmental Management 1
MECH 526 (3) Manufacturing and the Environment
MGPO 440 (3) Strategies for Sustainability*
PHIL 343 (3) Biomedical Ethics
RELG 270 (3) Religious Ethics and the Environment
SOCI 235 (3) Technology and Society
SOCI 312 (3) Sociology of Work and Industry
URBP 201 (3) Planning the 21st Century City
*Note: Management courses have limited enrolment and registration dates. See Important Dates at www.mcgill.ca/importantdates.

Group B - Humanities and Social Science, Management Studies and Law
Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credits for 3 credits (one course) from the Complementary Studies Group B list.

6 credits of courses at the 200-level or higher from the following departments:
Anthropology (ANTH)
Economics (any 200- or 300-level course excluding ECON 227 and ECON 337)
History (HIST)
Philosophy (excluding PHIL 210 and PHIL 310)
Political Science (POLI)
Psychology (excluding PSYC 204 and PSYC 305, but including PSYC 100)
Religious Studies (RELG)
School of Social Work (SWRK)
Sociology (excluding SOCI 350)

OR from the following courses:

ARCH 528 (3) History of Housing
BUSA 465* (3) Technological Entrepreneurship
ENVR 203 (3) Knowledge, Ethics and the Environment
ENVR 400 (3) Environmental Thought

FACC 220 (3) Law for Architects and Engineers
FACC 500 (3) Technology Business Plan Design
FACC 501 (3) Technology Business Plan Project

9.0 List of proposed program for the New Program/Major or Minor/Concentration (cont.)

INDR 294* (3) Introduction to Labour-Management Relations
MATH 338 (3) History and Philosophy of Mathematics
MGCR 222* (3) Introduction to Organizational Behaviour
MGCR 352* (3) Marketing Management 1
ORGB 321* (3) Leadership
ORGB 423* (3) Human Resources Management

*Note: Management courses have limited enrolment and registration dates. See Important Dates: www.mcgill.ca/importantdates.

Language Courses

If you are not proficient in a certain language, no more than 3 credits will be given for 6 credits of courses at the 100 level or higher in that language. A maximum of 3 credits of language courses will be counted toward the Complementary Studies requirement.

However, 3-6 credits may be given for language courses at the 200-level or higher that have a sufficient cultural component. These courses must be approved by the Engineering Student Centre (Frank Dawson Adams Building, Room 22).

Elective Courses
0-9 credits

Students from Quebec CEGEPs must take 9 credits of elective courses. These can be chosen from any course at the 200-level or higher offered by the University, subject to permission of the offering department.

4.0 Rationale and Admission Requirements for New Proposal

Bioengineering at McGill

At McGill, Bioengineering, as an over-arching research and teaching activity, is conceived and designed as having three branches, each corresponding to a current concentration of particular expertise and focus in one of the respective Faculties. The three pillars of bioengineering at McGill are: i) the broad-based fundamental approach of the Faculty of Engineering with an emphasis on engineering aspects, in particular those focused on biology-based applications at the Department of Bioengineering, ii) the clinical health-care aspects and life sciences applications promoted by the Department of Biomedical Engineering in the Faculty of Medicine, and iii) the agricultural and environmental focus of the Department of Bioresource Engineering in the Faculty of Agricultural and Environmental Sciences. Within the Faculty of Engineering, bioengineering has been one of the fastest areas of growth in research activity, highlighting McGill's commitment to this domain. In the last ten years, nineteen new faculty members whose research focuses on Bioengineering have been hired within the Faculty of Engineering, of which seven in the newly created Department of Bioengineering. These new recruits join many established researchers whose research is wholly or partially concerned with Bioengineering.

The goal of the proposed program is to impart to undergraduate students a solid training in the fundamentals of bioengineering and an exposure to specialized topics in specific areas of bioengineering expertise covered by the members of the Department of Bioengineering, with additional help from the faculty members in the Faculties of Engineering, Medicine, and Agricultural and Environmental Sciences. These areas can be divided roughly into two main disciplines – health-care related and non-health-care related. A few illustrative examples of health-care related research activities, a sub-discipline normally referred to as Biomedical Engineering, currently being carried out by staff in the Department of Bioengineering (highlighted in *italics*) and Faculty of Engineering at large are:

- *Nanoparticle-based imaging and drug delivery for cancer*
- *Tissue engineering constructs replacing animal models for drug discovery*
- *Hybrid networks comprising neuronal cells grown on microelectronic chips*
- *Prediction of protein adsorption for the design of biomaterials and medical instruments*
- *High sensitivity devices for rapid diagnostics in hospital-based diseases*
- *Modeling and simulation of human physiology networks*
- Development of statistical computer vision techniques for image-guided neurosurgery
- Modeling of speech biomechanics
- Engineering analysis of cardiovascular pathology
- Design of prosthetic heart valves
- Microwave imaging of breast tissue
- Growth and repair of cartilage
- Bioactive scaffolds for bone and cartilage regeneration
- Modeling of cardiovascular systems
- Modeling of embryogenesis
- Design of neural implants and man-machine interfaces
- Design of intelligent drug delivery systems

While much of bioengineering is focused on health-care and medicine, this is only a fraction of the broad scope of bioengineering. Bioengineering also encompasses the application of existing engineering knowledge and processes to the solution of problems involving living organisms and systems. A significant portion of the activity in the bioengineering field deals with non-health-care related topics. A few illustrative examples of such activities from the activities of the academic staff in the Department of Bioengineering (in italics) and Faculty of Engineering at large are:

- *Dynamic nanodevices based on protein molecular motors for rapid-response biosensors*
- *Extreme sensitive devices based on nanostructured surfaces for high throughput screening in genomics and proteomics*
- *Engineered processes of biological-based fabrication of chemical species by bacterial and insect cells*
- *Biologically-inspired algorithms for space searching used by microorganisms*
- *Biologically-inspired active materials, which change shape and properties in response to environmental changes*
- The creation of biologically inspired materials, such as using spider silk as a model for high performance polymers, environmentally friendly composite materials based on ultra-strong cellulose nano-crystals, and high performance materials based on nacre from mollusk shells.
- Design of bio-mimetic robots based on biological systems, such as autonomous flying machines derived from models of insect wing structures and control systems.
- Development of neuromorphic computing systems based on models of the physiology and architecture of vertebrate nervous systems.

- Augmentation of human capabilities through means such as the use of robotic exoskeletons for safely increasing the strength and dexterity of industrial workers or human-computer interfaces and intelligent information display devices that infer and employ the cognitive status of the observer.
- Design of burners utilizing biomass for cogeneration of heat and electricity.
- Creation of nano-biosensors that make use of biological compounds to aid in the detection of environmental pollutants or the presence of hazardous substances.
- Design of bio-remediation or bio-degradation processes for cleanup of environmental pollution or handling of wastes.
- Development of environmentally friendly microbial biosurfactants.

Currently in the Faculty of Engineering there is only a limited access for undergraduates to training in bioengineering, primarily through the Minor in Biomedical Engineering. Elsewhere at McGill, undergraduate students can enroll in the Bioresource Engineering program, but this has a particular focus on agricultural and environmental bioengineering. The only currently available program in Biomedical Engineering is at the graduate level, offered by the Faculty of Medicine. There is a clear need for an accredited undergraduate degree program in engineering providing a fundamental training in the broad area of engineering in the life sciences. The proposed program will be complementary to the existing Bachelor of Engineering in Bioresource Engineering, which focuses on agricultural engineering, food and bioprocessing, ecological engineering, soil and water engineering, and bio-environmental engineering. It would also provide a solid life sciences and engineering background for those wishing to continue in Biomedical Engineering at the graduate level.

The proposed program is comparable in style and workload to the other B.Eng. programs offered by the Faculty of Engineering, and the steady-state enrolment is expected to be similar to that of the Materials Engineering or Chemical Engineering programs. The program will be directed by a departmental committee with additional members from the Faculty of Engineering, Faculty of Medicine (from the Department of Biomedical Engineering) and the Faculty of Agricultural and Environmental Sciences (from the Department of Bioresource Engineering).

Definition of the body of knowledge for the proposed program

Bioengineering is an emerging engineering discipline at the interface between life sciences, medicine and engineering, with all sides acting as recipients and creators of knowledge. It is a rapidly emerging 21st century field with considerable commercial and societal value. McGill's strategic research plan of 2008 lists bioengineering as an existing area of strength and of current and future investment within McGill.

The definition of bioengineering, as well as its relation with its associated disciplines, biological engineering, biomedical engineering and bioresource engineering, evolved in time and in step with the evolution of the field. While a unanimously agreed definition of bioengineering has not been reached, this program is structured around more recent definitions, especially those that educated similar programs at Massachusetts Institute of Technology (MIT) and Imperial College, London, UK. MIT defines Biological-, Biomedical- and Bio-Engineering as follows:

- *Biological Engineering* is a new engineering discipline based in modern Life Sciences, where Engineering principles in design, synthesis, and analysis are applied to Biology, at the molecular, cellular, tissue, organ, organism and population level.
- By contrast, *Biomedical Engineering* deals with the application of traditional engineering disciplines to medical problems without any necessary in-depth knowledge of Life Sciences. In other words, Biological Engineering is the discipline of using engineering principles and quantitative measurements to be able to both understand and engineer biological systems, starting from molecules.
- *Bioengineering* is a term often used to encompass facets of both Biological and Biomedical Engineering.

Alternatively, the Department of Bioengineering at Imperial College London, UK, describes Bioengineering as a field that comprises

- *Biomedical Engineering*, which aims to make devices that replace, support or monitor biological systems; and to engineer devices, constructs and interventions for human health;
- *Biological Engineering*, which aims to solve problems related to Life Sciences and the application thereof;
- *Biomimetics*, which aims to derive new technical solutions from biological systems that have evolved efficient engineering solutions and provide biologically inspired designs (bionics).

Analysing the various definitions of Bio-, Biomedical and Biological Engineering, integrating the various strengths of, and needs at McGill University; as well as the projected evolution of the discipline and its socio-economic impact, *this Bioengineering program* aims to train students at undergraduate level in both

- biological engineering, which integrates biological knowledge in engineering practice, for generic applications in life sciences and biomimetics; and
- biomedical engineering, with a converging focus on applications in medicine.

Objectives of the proposed program

Following this strategic background, *the general objectives* of the program are:

- To provide the student with the ability to apply systematic knowledge of biology, physical sciences and mathematics; and sound engineering foundations in order to solve problems of a biological nature;
- To prepare students for the broad area of bioengineering, incorporating both biology-focused biological engineering and medicine-focused biomedical engineering.

The *specific objectives* of the program are:

- Through courses offered by the Faculties of Engineering, Science, Medicine and Agricultural and Environmental Sciences, the students will acquire fundamental knowledge in bioengineering-related natural sciences and mathematics; as well in the foundations of general engineering and bioengineering.
- Through courses offered by the Faculties of Engineering, Medicine, and Science, the students will acquire knowledge in *areas of specialisation of bioengineering*
  - Biological materials and biomechanics;
  - Biomolecular and cellular engineering; and
  - Biomedical, diagnostic and high throughput screening engineering.
- The students will learn to complete problem solving efforts both as individuals and as part of teams, working in laboratories and carrying out practical bioengineering projects.
- The students will develop effective written and oral communication skills for their preparation as professional engineers.
- The students will learn about the social impact and ethical and humanitarian issues related to working within the engineering field.

Market analysis and job prospects

The significant global growth of the field of Bioengineering demands increased numbers of highly qualified personnel (HQP). This is especially true in Quebec with its many biotechnology, biopharmaceutical and medical device companies, which range from start-ups to established companies, constituting ample receptor capacity for the graduates of the B.Eng.; Major in Bioengineering. Quebec has the fourth-highest number of biotechnology companies of any province or state in North America.

In its most recent occupational outlook, the U.S. Department of Labor states that among the practitioners of all engineering disciplines Biomedical engineers will experience the fastest growth of employment over the next decade. The report also states

> "Biomedical engineers *are expected to have employment growth of 72% over the projections decade, much faster than the average* [about 12%] *for all occupations*. *The aging of the population and a growing focus on health issues will drive demand for better medical devices and equipment designed by biomedical engineers. Along with the demand for more sophisticated medical equipment and procedures, an increased concern for cost-effectiveness will boost demand for biomedical engineers, particularly in pharmaceutical manufacturing and related industries*."[1]

This will bring the total employment for biomedical engineers in the U.S. near to that of chemical engineers and higher than that of petroleum engineers. The report "Occupational employment projections to 2018"[2] projects the 10-year growth in employment of biomedical engineers to be 72%. The next highest growth rate for an engineering occupation is software engineering at 34%. The report lists "*Bachelor degrees*" as the most significant source of training for these new positions.

Rationale for the name "Bioengineering"

It is proposed that the name of the new undergraduate program be "Bioengineering." The name "Bioengineering" was selected based on an in-depth survey of similar programs at institutions across North America and Europe. It was found that most of these programs are called either "Bioengineering", "Biomedical Engineering" or, less often, Biological Engineering. The evolution of Biomedical Engineering, Bioengineering and Biological Engineering has been reflected in an evolution of the definitions regarding these areas of study and practice.

[1] Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2010-11 Edition*, Engineers, on the Internet at http://www.bls.gov/oco/ocos027.htm

[2] *Alan Lacey and Benjamin Wright* , "Occupational employment projections to 2018", Monthly Labor Review Online, Vol. 132, No. 11, November 2009

The following is the denomination of all undergraduate, non-agricultural biology-related engineering programs in Canada:

- UBC: Chemical and Biological Engineering (B.App.Sc)
- Carleton University: Biomedical and Electrical Engineering (B.Eng.), Biomedical and Mechanical Engineering (B.Eng.)
- Dalhousie University: Biological Engineering (M.Eng.)
- École Polytechnique de Montréal: Génie Biomédicale (Baccalaureat)
- Guelph: Biological Engineering; and Biomedical Engineering (B.Sc.)
- Manitoba: Biosystems Engineering (B.Eng.)
- McMaster: Chemical Engineering & Bioengineering (B.Eng.Biosci.); Electrical & Biomedical Engineering (B.Eng.)
- Ottawa University: Biomedical Mechanical Engineering (B.Eng)
- Ryerson: Biomedical Engineering (B.Eng.)
- Sherbrooke: Génie Biotechnologique (Baccalaureat)
- Victoria: Biomedical Engineering (B.Eng.)

Some of the programs listed above derive from Electrical Engineering, i.e., Carleton, Manitoba, Ryerson and Victoria, and are focused solely on medical applications. Other programs, such as those at Guelph, UBC, and Sherbrooke, derive from chemical engineering and are more focused on biotechnology. Finally, ECP and Guelph offer a broader background in bioengineering (at Guelph via two sister programs in Biological and Biomedical Engineering), but they are again focused on biomedical, or food processing, respectively. In contrast with these Canadian programs, and following models at world-wide leaders in tertiary education, e.g., MIT in USA and Imperial College in UK, we propose a program that delivers a solid background of biology *and* engineering, which allows unencumbered student development towards biomedical, biological and biomimetics applications.

Following previous work by the National Institutes of Health (NIH), Bioengineering was defined in 1998 by a US Congress document[3], which states:

> *Bioengineering is an interdisciplinary field that applies physical, chemical, and mathematical sciences and engineering principles to the study of biology, medicine, behavior, and health. It advances knowledge from the molecular to the organ systems level, and develops new and novel biologics, materials, processes, implants, devices, and informatics approaches for the prevention, diagnosis, and treatment of disease, for patient rehabilitation, and for improving health.*

However, this decade-and-a-half old definition was revisited by the Department of Biological Engineering[4] at MIT (which provided much of the benchmarks for the design of the proposed undergraduate program), as well as the Department of Bioengineering at Imperial College London, UK[5] as presented before.

Analysing the various definitions of Bio-, Biomedical and Biological Engineering, integrating the various strengths of, and needs at McGill University; as well as the projected evolution of the discipline and its socio-economic impact, this Bioengineering program aims to train students at undergraduate level, in an integrative and synergistic manner, in both biological engineering and biomedical engineering.

In the U.S., at least 35 universities (listed below) offer undergraduate programs entitled “Bioengineering”. Many of these programs reside in departments that are also named Bioengineering (marked with [1]). 15 of these programs are accredited by ABET (Accreditation Board for Engineering and Technology), marked with [2].

Arizona State University[1]
California Institute of Technology
Clemson University
Lehigh University1
Oregon State University[1]
Penn State University[1,2]
North Carolina A&T[2]
Rice University[1]
University of California, Los Angeles [2]
University of California, Riverside[2]
University of California, San Diego[1,2]
University of Illinois, Chicago[1,2]
University of Illinois, Urbana [2]
University of Maryland[1,2]
University of Pennsylvania[1]
University of Pittsburgh[1,2]

3. 4 H.R. 4170 “A Bill to amend the Public Health Service Act to establish a National Center for Bioengineering Research.” http://www.gpo.gov/fdsys/pkg/BILLS-105hr4170ih/pdf/BILLS-105hr4170ih.pdf
4. http://web.mit.edu/be/index.shtml
5. http://www3.imperial.ac.uk/bioengineering

Stanford University[2]
SUNY Binghamton[1,2]
SUNY Stony Brook
Syracuse University[1]
University of California, Berkeley[2]
University of Toledo[1]
University of Washington[1,2]
University of Utah[2]
Washington State University[1]

None of the bioengineering programs listed above cover “agricultural” or “bioresource” activities, and thus there should be no confusion that our proposed program is an agricultural engineering program.

The following list shows the U.S. universities which have ABET-accredited programs in the area of agricultural engineering, along with the names of their programs. Four of these schools (indicated by *) also have a bioengineering program in addition to their agricultural engineering program, showing that such programs can co-exist in the same institution.

University of Arizona: Biosystems Engineering
University of Arkansas: Biological Engineering
Auburn University: Biosystems Engineering
Cal. Poly. State. San Luis Obispo: Bioresource and Agricultural Engineering
University of California, Davis: Biological Systems Engineering
* Clemson: Biosystems Engineering
Cornell University: Biological Engineering
Florida A&M: Biological and Agricultural Systems Engineering
University of Florida: Agricultural and Biological Engineering
University of Georgia: Agricultural Engineering
University of Hawaii: Biological Engineering
University of Idaho: Biological and Agricultural Engineering
*University of Illinois Urbana-Champaign: Agricultural Engineering
Iowa State University: Agricultural Engineering
Kansas State University: Biological and Agricultural Engineering
University of Kentucky: Biosystems and Agricultural Engineering
Louisiana State University and A&M College: Biological Engineering
University of Maine: Biological Engineering
*University of Maryland: Biological Resources Engineering
Michigan State University: Biosystems Engineering
University of Minnesota-Twin Cities: Biosystems and Agricultural Engineering
Mississippi State: Biological Engineering
University of Missouri: Biological Engineering
University of Nebraska: Agricultural Engineering and Biological Systems Engineering
North Carolina State University: Biological Engineering
North Dakota State University: Agricultural and Biosystems Engineering
Ohio State University: Food, Agriculture and Biological Engineering
Oklahoma State University: Biosystems Engineering
*Penn State University: Biological Engineering
Purdue University: Agriculture and Biological Engineering
South Dakota State University: Agriculture and Biosystems Engineering
University of Tennessee: Biosystems Engineering
Texas A&M: Agricultural Engineering and Biological Systems Engineering
Utah State University: Biological Engineering
Virginia Polytechnic Institute: Biological Systems Engineering
University of Wisconsin-Madison: Biological Systems Engineering

As presented above, our proposal builds on this large body of University teaching and research, following the leaders in the field, i.e., MIT and Imperial College, which start from the building of a thorough background in biology, closely followed by engineering knowledge and methodology, to reach out to biomedical, life sciences and biomimetics applications. As such, the proposed program is the first of its kind in Canada.

The University of Maryland website (http://www.bioe.umd.edu/undergraduate#whatisbioe) gives a summary of the differences between the various forms of bio-related engineering programs.

Admission requirements

Admission requirements to the B.Eng.; Major in Bioengineering will be the same as for other B.Eng./B.S.E. programs offered by the Faculty of Engineering. Note: Biology is not a prerequisite for the program, as students are required to take BIOL 112 in their first year unless they have transfer credits from CEGEP

Admission from CEGEP
General Requirements:

- Diplôme d'études collégiales (DEC) science related pre-university program
- Candidates who have completed studies leading to a three-year professional DEC (Tech DEC) are considered for admission if they have a suitable background and have completed appropriate prerequisite courses.

Prerequisites:

- Mathematics – 201-NYA, NYB, NYC (00UN, 00UP, 00UQ)
- Chemistry – 202-NYA, NYB (00UL, 00UM)
- Physics – 201-NYA, NYB, NYC (00UR, 00US, 00UT)

Admission from Ontario high schools
General Requirements:

- Completion of the Ontario Secondary School Diploma (OSSD)
- A minimum of six 4U, and/or 4M (or OAC) courses, with at least four (including all prerequisites) at the 4U (or OAC) level.

Prerequisites:

- Calculus and Vectors MCV4U (or Calculus MCB4U or Geometry MGA4U)
- Chemistry SCH4U
- Physics SPH4U
- 4U English (for institutions where English is the language of instruction) or French (for institutions where French is the language of instruction)

Admission from other Canadian provinces
General Requirements:

- High school graduation diploma which leads to admission to a university in the student's home province
- Admission is based on McGill's calculation of the "top five" Grade 12 level course average.

Prerequisites:

- Grade 12 Mathematics (pre-calculus)
- Grade 12 Chemistry
- Grade 12 Physics
- Grade 12 English or French

Admission from U.S. high schools

General Requirements:

- High school diploma from an accredited school which meets the requirements for admission to a university or college in the USA.
- Minimum B+ average in each of the final three years of high school and marks of B+ or better in prerequisite courses.
- Rank in upper 20 to 25% of class.
- ACT OR THE SAT 1 and two SAT II subject tests are required.
    - 600-650 for SAT I or ACT 26
    - 540-580 – SAT II (SAT IIs must include Mathematics and at least one of Chemistry or Physics

Prerequisites:

- Pre-Calculus (functions)
- Chemistry
- Physics

Admission based on Advanced Level Examinations (GCE A-Levels)
General Requirements:

- At least five different General Certificate of Secondary Education subjects
- At least two Advanced-Level subjects (Mathematics, Chemistry, Physics).
- Mathematics, Chemistry, Physics must all be taken at the GCSE level.

- Advanced level subject results are indicated by one of the six grades: A* (a*), A (a), B (b), C(c), D (d), E (e) of which grade A* (a*) is the highest and grade E (e) is the lowest pass. AS results are still reported on a five-point scale with no A* (a*) grade.
- Higher grades are expected if applicants are being considered based on Predicted Grades.

Prerequisites:
- Three Advanced-Level (AL) subjects (including a minimum of two from Mathematics, Chemistry, Physics) or
- Two Advanced-Level (AL) and two Advanced Subsidiary (AS) in different subjects (including a minimum of two from Mathematics, Chemistry, Physics).

Admission based on French Baccalaureate Diploma
General Requirements:
- Series S
- Baccalaureate in "premiere groupe" with a minimum overall "mention" of "assez-bien" and minimum grades of 10/20 in Mathematics and Physical Sciences.

Admission based on the International Baccalaureate Diploma
General Requirements:
- Students in the process of completing the second year of study in the IB Diploma will be consider on the basis of the last two years of school results and predicted results.

Prerequisites:
- Mathematics, Chemistry and Physics at Higher Level (HL) or Standard Level (SL)
- Subsidiary Level (SL) Mathematics is the minimum level of Math

Admission from other overseas high schools
General Requirements:
- McGill follows the guidelines as outlined by the Country Index by the International Education Research Foundation for students entering on the basis of high school qualifications.
- Admissions decisions take into account the vast variation in grading schemes.

Prerequisites:
- Pre-calculus course in Functions, Chemistry and Physics.

Admission from other universities or other programs
General Requirements:
- Students applying to transfer to complete their first degree or to undertake a second bachelor's degree are considered on the basis of university/college work and previous studies. Above-average grades are expected.
- Particular attention will be paid to results of courses relevant to the proposed program of study.

Prerequisites:
- One semester each of differential calculus, integral calculus, and linear algebra
- Two semesters of chemistry and two semesters of physics, with labs.
- It is possible to be admitted with a minimum of two semesters of calculus plus two semesters of chemistry or physics.

Course proposals submitted concurrently
Proposals for the following new BIEN courses (listed in the proposed program) are being submitted in the Engineering Report 6.13-14 to Enrolment Services for the SCTP meeting of March 13th:
- BIEN 200 Introduction to Bioengineering (2 credits) [PRN 7439]
- BIEN 210 Electrical and Optical Properties of Biological Systems (3 credits) [PRN 7438]
- BIEN 290 Bioengineering Measurement Laboratory (4 credits) [PRN 7440]
- BIEN 310 Introduction to Biomolecular Engineering (3 credits) [PRN 7441]
- BIEN 330 Introduction to Tissue Engineering (3 credits) [PRN 7442]
- BIEN 390 Bioengineering Laboratory (3 credits) [PRN 7443]
- BIEN 470 Bioengineering Design Project (6 credits) [PRN 7444]
- BIEN 471 Bioengineering Research Project (2 credits) [PRN 7445]
- BIEN 510 Nanoparticles in the Medical Sciences (3 credits) [PRN 7446]
- BIEN 520 High Throughput Bioanalytical Devices (3 credits) [PRN 7447]
- BIEN 530 Imaging and Bioanalytical Instrumentation (3 credits) [PRN 7448]
- BIEN 550 Biomolecular Devices (3 credits) [PRN 7449]
- BIEN 560 Biosensors (3 credits) [PRN 7450]
- BIEN 570 Active Mechanics in Biology (3 credits) [PRN 8118]

10.0 Approvals

Routing Sequence	Name	Signature	Date
Department	Dan Nicolau		Feb 24. 2014
Curric/Acad Committee	Mohamed Mequid		Feb 26. 2014
Faculty 1	Mohamed Mequid		Feb 26. 2014
Faculty 2			
Faculty 3			
CGPS			
SCTP	SCTP		March 13. 2014
APC	APC		May 15. 2014
Senate			

Submitted by

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Submission Date	January 29. 2014

To be completed by ARR:

CIP Code