Vancouver Senate

THE THIRD REGULAR MEETING OF THE VANCOUVER SENATE
FOR THE 2016/2017 ACADEMIC YEAR

WEDNESDAY, 16 NOVEMBER 2016

6:00 P.M.

ROOM 182, IRVING K. BARBER LEARNING CENTRE, 1961 EAST MALL

1. Minutes of the Meeting of 19 October 2016 – Dr Santa Ono
   (approval) (docket pages 3-23)

2. Business Arising from the Minutes – Dr Santa Ono
   Motion Referred at the Previous Meeting – Dr Richard Anstee (approval) (docket page 24)

3. Remarks from the Chair & Related Questions – Dr Santa Ono (information)

4. Tributes Committee – Dr Sally Thorne
   Memorial Minutes for Drs John Chapman, Myer Bloom, and Robert Blake
   (approval)(docket pages 25-28)

5. Candidates for Degrees – Dr Santa Ono (approval)
   The list as approved by the faculties is available for advance inspection at the Senate office, and will also be available at the meeting.

   The Chair of Senate calls for the following motion:

   "That the candidates for degrees and diplomas, as recommended by the faculties, be granted the degrees for which they were recommended, effective November 2016, and that a committee comprised of the Registrar, the dean of the relevant faculty, and the Chair of Senate be empowered to make any necessary adjustments.

   (2/3 majority required)."

6. Academic Policy Committee – Dr Paul Harrison
   Revisions to Graduate and Post-Doctoral Studies’ Academic Regulations (approval)
   (docket pages 29-35)

7. Admissions Committee – Dr Robert Sparks
   a. Faculty of Graduate & Postdoctoral Studies: Admission to Doctoral Programs (approval) (docket pages 36, 38-42)
b. Changes to Undergraduate Direct-Entry Programs Admission Requirements: First Nations Studies 12 (approval) (docket pages 36-37, 43-46)

8. Awards Committee – Dr Lawrence Burr
   New and Revised Awards (approval) (docket pages 47-52)

9. Curriculum Committee – Dr Peter Marshall
   November Curriculum Proposal for the Faculty of Graduate and Postdoctoral Studies (approval) (docket pages 53-55)

   New Program: Specialization in Biomedical Engineering, in the Bachelor of Applied Science (approval) (docket pages 56-131)

11. Nominating Committee – Dr Richard Tees
   a. Appointments to the President’s Advisory Committees for the Selection of a Vice-President Academic and Provost (approval) (docket page 132-134)
   b. Appointments to the President’s Advisory Committee for the Selection of a Vice-President Research & International (approval) (docket pages 134-135)
   c. Adjustments to Committee Assignments (approval) (docket page 135)

12. IN CAMERA – Tributes Committee – Dr Sally Thorne
   Honorary Degree Nominations (approval) (to be circulated at meeting)
VANCOUVER SENATE

MINUTES OF 19 OCTOBER 2016

DRAFT

Attendance

Present: Dr S. J. Ono (Chair), Dr K. Ross (Secretary), Mr T. Ahmed, Dr R. Anstee, Mr K Baimbridge, Mr M. Bancroft, Ms E. Biddlecombe, Dr L. Burr, Dr H. Brock, Ms D. Coulbourn, Mr N. Dawson, Dr A. Dulay, Mr B. Fischer, Dr S. Forwell, Dr D. Gillen, Mr S. Haffey, Acting Dean K. Harrison, Dr P. Harrison, Dean R. Helsley, Ms M. Huron, Dr A. Ivanov, Mrs C. Jaeger, Dr P. Keown, Mr D. Lam, Mr H. Leung, Dr P. Loewen, Dr K. Lo, Dr D. MacDonald, Mr K. Madill, Ms A. Maleki, Dr P. Marshall, Dr W. McKeel, Dr W. McNulty, Dr C. Naas, Dean S. Peacock, Dr G. Peterson, Dr A. Redish, Dr A. Richardson, Dr C. Ruitenberg, Mr I Sapollnik, Dr T. Schneider, Dr S. Singh, Ms S. So, Mr J. Solis, Dr R. Sparks, Mr J. Speidel, Dr R. Tees, Ms Daphne Tse, Dr L. Walker, Ms K. Williams, Dr D. Witt, Dean R. Yada.

Regrets: Dr P. Adebar, Dr S. Avramidis, Ms L. Castro, Dr. A. Collier, Dean M. Coughtrie, Dean C. Dauvergne, Dr Wm. Dunford, , Dean B. Frank, Dr J. Gilbert, Dr C. Godwin, Mr B. Goold, Chancellor L. Gordon, , Dean J. Innes, Ms T. Johnson, Dean D. Kelleher, Dr S. Knight, Ms H. Kwan, Dr B. Lalli, Dr B. MacDougall, Dr P. Meehan, Dr C. Nislow, Dean M. ParLange, Dr N. Perry, Dean S. Porter, Dr A. Riseman, Dr L. Rucker, Ms B Sawatsky, Dean C. Shuler, Ms S. Sterling, Dr S. Thorne, Dr R. Topping, Dr R. Wilson, Mr S. Zbarsky.

Clerk: Mr C. Eaton.

Call to Order

The Chair of Senate, Dr Santa J Ono, called the second regular meeting of the Vancouver Senate for the 2016/2017 Academic Year to order at 6:02 pm.

Senate Membership

The Secretary welcomed to Senate Dr Kin Lo, replacing Dr Frieda Granot as Representative of the Faculty of Commerce and Business Administration; and Mr Jeff Solis, replacing Ms Jolene Loveday as Student Representative of the Faculty of Education.

Dr Ross further welcomed convocation senator Mr Sean Haffey back to Senate after a medical leave.

Minutes of the Previous Meeting

Richard Tees
William McNulty

That the Minutes of the Meeting of 14 September 2016 be adopted as corrected.

Correction: Senator Ahmed was present.
Business Arising from the Minutes

The Chair of the Senate Nominating Committee, Dr Richard Tees, presented on the current situation regarding the Vice-President Academic and Provost and Vice-President Research and International Search Committee formations.

Dr Tees outlined the mandate of the Nominating Committee, and the joint Board and Senates policies that government academic administrative appointments. Of particular relevance for these searches was Policy 18, which was approved in 2008 and last revised by the Board and Senate in 2012. Dr Tees note that prior to 2012, the Senate’s appointments were limited to senators, after those revisions, either senators or non-senators could be appointed by the Senate. Since 2012, 4 searches have been completed under that policy, with a mixture of senators and non-senators being appointed.

Senator Tees expressed that there was a certain amount of urgency in forming these search committees. One could make the argument that Policy 18 was flawed in some way, but it seemed more important to move ahead with searches that have been delayed for more than a year now that President Ono was in place.

Dr Tees outlined the timeline of the search committee formation, including:
- an initial request from the President’s office (September 2),
- the meeting of the Nominating Committee (September 6),
- contacting candidates and the finalization of the Senate Agenda (September 7-9),
- the publication of the Senate Agenda (September 9)
- concerns raised by the Faculty Association regarding some names proposed (September 11)
- A request by the President for the Nominating Committee to postpone its recommendations to give time to hear the Faculty Association's concerns (September 12)
- A broadcast email from the president indicating that the Senate would be inviting nominations of students and faculty members (September 13)
- a subsequent meeting of the Nominating Committee to decide how to proceed (October 4)
- a Broadcast email from the Nominating Committee seeking further nominations (October 11), with Nominations due October 20:

Senator Tees noted that the Committee will be meeting in late October or early November to consider nominees and make further recommendations to Senate. He expressed his hope that the Senate will accept the resulting nominations, and that these nominees would underline the importance of the Senate’s role in academic governance.

Senator Haffey expressed a concern that as a convocation senator he had not received any calls for nominations, and that the pool of nominees being limited to faculty members or students.
Dr Tees replied that there were two convocation senators on the Nominating Committee itself, but Policy 18 limited the appointees to being faculty members or students and not any senators as it had been with previous searches. He advised that as he noted earlier, Policy 18 could be revised again but that would cause further delays.

Senator Singh noted that Faculty Association has also pointed out in a recent email to faculty that there could be conflicts of interests, perceived or real, for some members originally recommended for these committees. He asked what could be done to ensure conflicts were addressed.

Senator Tees replied that when the report is presented to the Senate, the Senate will have an opportunity to speak to or question any of the recommendations and to alter any recommendations made. If anyone wishes to raise a conflict of interest, they could do so at that time.

Senator Anstee expressed that it was important to have policies guide our work, and while it was unfortunate for the Nominating Committee that more work was required, he described it as a positive thing that more members of the campus community were interested. He hoped that the small delay would be worth it to allow more faculty participation in processes.

Dr Tees agreed, and further expressed that searches had many opportunities in excite the campus community to try to help determine who would make a great provost.

Remarks from the Chair

The President noted for Senate that preparation for UBC’s next strategic plan were underway as announced in a broadcast email the previous day. A group has been assembled to help selected a search consultant, and input will be sought on the search process from across all of UBC. Dr Ono noted that the plan processes had taken between one and one and one half years in the past.

Dr Ono further advised that UBC was in the process of selecting search consultants for the Vice-President Academic and the Vice-President Research and International searches in anticipation of both those search committee been formed next month.

Senator Richardson noted that the broadcast email mentioned an advisory committee had been formed, and asked if the membership has been released yet.

The President replied not yet, but this would be communicated shortly. He further advised that the advisory committee’s role presently would be helping in the selection of a consulting firm.

Tributes Committee

DR. DAVID MEASDAY

Dr. Measday moved to Vancouver in 1970, joining what was then the Department of Physics to work with the new TRIUMF accelerator, which was still under construction. Born in London in
1937, as a child Dr. Measday was twice evacuated to the English countryside to avoid bombing during the Second World War. He then went on to study at Kings College School in Wimbledon and Wadham College, Oxford, where he obtained both a Bachelor of Arts and Doctor of Philosophy.

Before moving to Canada, Dr. Measday spent three years as a post-doctoral fellow at Harvard University’s Cyclotron Laboratory, developing a mono-energetic neutron beam and measuring the neutron-proton interaction. He also spent some years working as a post-doctoral fellow in Geneva, Switzerland, before joining the staff at the Synchrocyclotron at CERN.

After taking up his position at UBC, Dr. Measday continued to travel, spending time experimenting at both the University of Washington in Seattle and at Berkeley, where he studied various properties of pions and muons.

Dr. Measday became Associate Dean of Science in 1990, and took on the role of Acting Dean from 1997 to 1998, serving as a member of Senate in this capacity. During his tenure, Dr. Measday led the Faculty of Science through the move to computer-centred laboratories, as well as assisting with the reorganization of the Departments within the Faculty.

After his retirement in 2002 Dr. Measday continued to teach, but also served as treasurer of the Professors Emeriti for four years and a member of the President's Advisory Committee on Campus Enhancement.

To his family and friends, the Senate and the University of British Columbia offers their condolences and thanks.

DR. DONALD BROWN

One of Canada’s most distinguished philosophers, and a popular and dedicated teacher, Dr. Donald Brown graduated from UBC in 1947 with a Bachelor of Arts in Honours Philosophy. He went on to obtain a further BA in Philosophy, Politics and Economics from Corpus Christi College, Oxford, in 1950, before receiving his Doctor of Philosophy from Magdalen College, Oxford, in 1955.

Returning to UBC’s Philosophy Department – first as an Assistant Professor and later as a Full Professor – and, apart from one year spent teaching at Magdalen College in the late 1950s, he remained there until his retirement in 1985. Dr. Brown served as a Representative of the Joint Faculties on Senate between 1969 and 1975.

Outside of his academic career, Dr. Brown served on the Ethics Committee of the Vancouver General Hospital and, along with a number of his friends and colleagues, was a founder of the B.C. Civil Liberties Association.

To his family and friends, the Senate and the University of British Columbia offers their condolences and thanks.
DR. JANET STEIN

Born in Denver, CO, in October 1930, Janet Ruth Stein Taylor went on to graduate with a BA from the University of Colorado in 1951, and a Master of Arts from Wellesley College in 1953. Dr. Stein obtained her Doctor of Philosophy in Botany at the University of California, Berkeley, in 1957, and soon after won the ‘Dorbaker Award’ for the best phycological paper published in North America in 1960.

Dr. Stein joined UBC’s Department of Botany in 1959, having spent a couple of years working as a Technician at Berkeley and taking up various visiting positions at both the University Teachers Institute at Indiana University and the University of Minnesota Biological Station. After five years at UBC Dr. Stein became an Assistant Professor, and did much to shift gender imbalances within the Department of Botany and the Faculty of Science more generally; she went on to lead the Departmental advising group, and also served as Associate Dean of Science.

From September 1972 to December 1974 Dr. Stein was a Representative of the Joint Faculties on Senate, and she served again, this time representing the Faculty of Science, from 1984 until her retirement in 1985.

Beyond UBC, over the course of her career Dr. Stein was variously Director, Vice-President and President of the Canadian Botanical Association, and Treasurer and President of the Phycological Society of America, as well as editing a number of journals and new bulletins. Her research interests centred on the Freshwater and Estuarine Algae of British Columbia, but Dr. Stein also led extensive fieldwork and data base preparation for what is now part of the E-Flora of BC: Electronic Atlas of Plants of British Columbia.

To her family and friends, the Senate and the University of British Columbia offers their condolences and thanks.

Paul Keown
Paul Harrison

That Senate approve the Memorial Minutes for Dr. David Measday, Dr. Donald Brown and Dr. Janet Stein, that they be entered into the Minutes of Senate and copies be sent to the family of the deceased.

Approved

Admissions Committee

The Committee Chair, Dr Robert Sparks, presented.

BACHELOR OF ENVIRONMENTAL DESIGN
Robert Sparks
Richard Anstee

That Senate approve changes in admission requirements for applicants to the Bachelor of Environmental Design program, effective for admission to the 2017 Winter Session and thereafter.

POLICY J-55: THIRD-PARTY RECRUITMENT AGREEMENTS

See Appendix A: Policy J-55: Third Party Recruitment Agreements

Robert Sparks
William McNulty

That Senate approve Policy J-55: Third Party Recruitment Agreements.

Dr Sparks noted that the last set of guidelines were approved in 2006; two years ago the committee discussed those guidelines and that conversation went into the need for a formal policy and has been working on it since.

Dr Sparks outlined why units wanted to use agents.

Senator Singh asked if we would use our alumni as agents

Dr Sparks replied that we had extensive alumni networks that we did use, but this policy was focused on professional agents and undergraduate students.

Senator P. Marshall clarified that this policy would in no way limit faculty activities or alumni; it is to govern contractual arrangements with third parties acting on behalf of faculties. The concern we are trying to address is the potential damage to UBC’s reputation caused by agents acting inappropriately.

Joint Report of the Admissions and Curriculum Committees

NEW PROGRAM: PROFESSIONAL MASTER OF BUSINESS ADMINISTRATION

See Appendix A: Professional Master of Business Administration

Peter Marshall
Paul Keown

That the new Professional Master of Business Administration (P.M.B.A.) degree program, its associated revised program, and new and revised courses be approved.
Dr P. Marshall noted that while this was a new credential, it was not a new program in a sense for UBC as the Professional Master of Business Administration was similar to the current part-time version Master of Business Administration, which would be discontinued should the PMBA be approved.

Senator Haffey asked what the need was for having a new credential.

Senator Lo noted that one constraint in BC is that we have to work under the rules of the Ministry of Advanced Education. Our full-time and part-time MBAs are the same degree in the eyes of the Ministry, and there are negative aspects to that for students in terms of differentiating the degrees for potential students.

Senator Haffey asked if a graduate of this program said they had an MBA, would that be true?

The Registrar confirmed that we do release degree information for graduates, and as degree completions are in the public domain, we would confirm the correct degree title.

Senator Ruitenberg asked if we know of situations where two-tier MBAs were assumed based upon name variants.

Senator Lo advised that we already have multiple MBAs, with executive MBAs and international MBAs in addition to the original MBA degree.

Dean Helsley advised that the idea of the program was to have the pedagogy better meet the needs of students. The previous weekend-based experience was too draining. The new program with residencies spreads out work better. The faculty did have debates regarding the name, and the one settled on we feel best meets the kind of students we want to attract.

Senator Ruitenberg noted that she had no objection to the curricular structure, but she was concerned about the dual credential.

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Awards Committee

See Appendix B: Awards Report

Dr Lawrence Burr, Chair of the Committee, presented.

NEW AND REVISED AWARDS

<table>
<thead>
<tr>
<th>Lawrence Burr</th>
<th>Philip Loewen</th>
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</table>

That Senate accept the awards as listed and forward them to the Board of Governors for approval; and that letters of thanks be sent to the donors.

Dr Burr noted that $32 000 in new student aid was proposed for approval this month.
Nominating Committee

The Chair Senate Nominating Committee, Dr Richard Tees, presented.

ADJUSTMENTS TO COMMITTEE ASSIGNMENTS

Richard Tees
Robert Sparks

That Dr Alan Richardson be appointed to the Senate Curriculum Committee until 31 August 2017 and thereafter until replaced, to fill a vacancy; and
That the composition of the Ad Hoc Committee on Flexible Learning be reduced by one (1) senator and that Dr Lawrence Walker cease to be a member of the Committee.

PRESIDENT'S ADVISORY COMMITTEE FOR THE SELECTION OF A UNIVERSITY LIBRARIAN

Richard Tees
Peter Marshall

That Dr Thomas Schneider be appointed to the President’s Advisory Committee for the Selection of a University Librarian.

Senator Gilbert asked why the chair of the library committee wasn’t recommended.

Acting Secretary Eaton replied that while he could not divulge the deliberations of the Nominating Committee, in this case, the Chair of the Library Committee would not be eligible due to the 2012 amendments to Policy 18 as Dr Burr is a convocation senator and not a faculty senator.

DEVELOPMENT OF A POLICY ON THE RECOMMENDATION AND SELECTION OF A PRESIDENT

Dr Tees advised Senate that

Report from the Provost

NEW CHAIR: FIRST NATIONS HEALTH AUTHORITY CHAIR IN CANCER AND WELLNESS
That Senate approve the establishment of a new chair, to be named the First Nations Health Authority Chair in Cancer and Wellness.

Dr Redish noted that the First Nations Health Authority believe that this would be transformative for communities.

Dr Baimbridge noted that $150 000 per year of 10 years, plus the same from UBC. He asked if UBC would be one time or spread out.

The provost replied that it would also be over 10 years.

A number of minor concerns were raised regarding the contractual language in the MOU that the proposed agreed to address in consultation in the staff of the Senate office.

SENIOR ADVISOR TO THE PROVOSTS ON ACADEMIC FREEDOM

The Provost pro tem., Dr Angela Redish, introduced Dr Neil Guppy, Senior Advisor on Academic Freedom, who with permission of Senate presented on his recent work.

Dr Guppy began by outlining the Senate’s statement on Academic Freedom approved in December 1976, and then his position:

• Report to the Provosts (Vancouver and Okanagan)
• A tenured UBC faculty member seconded to this role for two years
• Appointee to develop a work plan (in consultation with multiple stake holders) in first three months.
• Support to both campuses

Dr Guppy then went over his specific roles and responsibilities:

• Work proactively with faculty, staff, governors and senators, and Faculty Association
• Provide advice, education and counsel regarding all issues involving academic freedom, and lead a dialogue to seek input from the community on the delivery of the mandate;
• Lead the creation of an education program that would be developed for all new faculty members, heads, directors, administrators and deans with a focus on fulfilling their obligation to protect academic freedom;
• Lead the development of an online tool to allow people to access information on what academic freedom is, why it is fundamental to a university, how to manage academic freedom issues, and answers to frequently asked questions;
• Lead the development of a more formalized module on academic freedom as part of the orientation and onboarding process for all new Governors and Senators;
• Develop an inventory of critical factors that provide the foundation for the protection of academic freedom;
• Identify the key opportunities for and risks to the safeguarding of academic freedom.

Dr Guppy noted that there are differences between free speech and academic freedom. He opined that faculty members were a privileged class, with that privilege came rights and responsibilities.

Richard Anstee noted that Lynn Smith’s report was on the web and suggested that it would be useful to also include information on the situation with Dr Sunera Thobani and the September 11th attacks on the United States of America.

Senator Richardson asked about academic freedom and social media.

Dr Guppy replied that his personal sense is that the way that faculty members disseminate ideas have exploded, and most colleagues views blogs and wikis as appropriate ways to distribute knowledge. The difference is that they are not peer reviewed and lack of imprimatur of a reviewed journal.

Senator Ono opined that he was familiar with a situation at another institution where tenure was withdrawn because of twitter comments.

Senator Baimbridge noted that when academics use social media it is blurry if that is an expert or a personal opinion.

Dr Guppy suggested that there were also professional and ethical codes to take into consideration.

Report from the Registrar

2016/2017 TRIENNIAL ELECTIONS

Dr Ross advised that UBC was entering its triennial election period. Keeping with past practice, UBC will be electing faculty members and staff to the Board of Governors, and the Joint Faculties members of Senate, in the autumn; and electing faculty-specific, convocation, and other senate positions in the spring.

Other Business

Richard Anstee
Alan Richardson

That Senate amend its Rules and Procedures to add a new section to follow Section 29 to read as follows: Section 29 notwithstanding, any Senator appointed to a committee of Senate may ask -by giving written or verbal notice through the Secretary or the Committee Chair - that a matter proposed for approval by that committee (or already approved by that committee within one month of the notice) under delegated
authority of Senate be not considered approved under that delegated authority and instead be brought to Senate for approval, provided that the matter is not an appeal or an otherwise confidential matter.

Dr Anstee explained the legislative history of delegated authority at Senate. He opined that for delegated authority should only be used for routine or uncontroversial matters, and thus it was important that senators on committees had the ability to require matters be referred to the full Senate for consideration.

**MOTION TO REFER**

Tariq Ahmed  
Susan Forwell  } That this motion be referred to the Senate Agenda Committee for review and that either the Committee or Dr Anstee report back at the next meeting of Senate.

**Adjournment**

There being no further business, the meeting was adjourned at 7:22 pm.
Appendix A: Policy J55: Third-Party Recruitment Agreements

Entry into and Management of Recruitment Agreements

1) The University and its units may seek to obtain recruitment services only from authorized agents.
2) The University may enter into written agreements with recruitment agents or agencies to provide recruitment services to the extent that those agreements do not contravene the policies or regulations of the University or the laws of Canada or British Columbia.
3) All recruitment agreements must be entered into on behalf of the University in accordance with this policy and must be signed pursuant to the applicable Signing Resolution. Units do not have the authority to enter into recruitment agreements independently of the University.
4) Units may recommend that the University enter into a recruitment agreement with a recruitment agent or agency. Prior to making such a recommendation, the unit must:
   a. Perform proper and sufficient due diligence to ensure that the recruitment agent or agency is bona fide and of good repute;
   b. Ensure that it has the capacity to support and manage the activities of the recruitment agent or agency such that it can ensure that the recruitment agreement would not result in any risk to the integrity of the University’s admission processes or any adverse legal or reputational effects on the University or any unit;
   c. Ensure that it has the capacity to monitor the activities of the recruitment agent or agency such that it can ensure that the recruitment agent or agency is in compliance with the recruitment agreement; and
   d. Ensure that the unit is not so reliant on the services provided in a recruitment agreement that a loss of the agreement would threaten the viability of the unit.
5) All recruitment agreements must be consistent with the contents of this policy and must specifically require recruitment agents or agencies to comply with the obligations of recruitment agents and agencies as set out in this policy.
6) A copy of any recruitment agreement must be submitted to the Office of the Provost and Vice-President Academic of UBC Vancouver and the Office of the Provost and Vice-Principal of UBC Okanagan, which will maintain publicly available registries of all authorized agents.
7) Units must manage, support and monitor the activities of all recruitment agents and agencies with which they are engaged, and must ensure that a review of the activities of these recruitment agents and agencies is conducted no less frequently than once every three years. Units at UBC Vancouver must notify the Office of the Provost & Vice-President Academic and Units located at UBC Okanagan must notify the Office of the Provost and Vice-Principal of any instances of non-compliance with recruitment agreements on the part of recruitment agents or agencies that are discovered by the unit.

Protection of Privacy

8) The University, units and all authorized agents and agencies must at all times take all necessary steps to protect the private and personal information of students and applicants including compliance with the applicable laws of Canada and British Columbia, as well
as compliance with the applicable laws of any jurisdiction in which an authorized agent or agency operates.

9) The University and its units must not distribute the personal information of students or applicants to recruitment agents or agencies except in compliance with the laws of Canada and British Columbia.

10) Authorized agents and agencies must not collect the personal information of students or applicants except in compliance with the applicable laws of Canada and in which the authorized agent or agency operates.

**Obligations of the University**

11) The University must make all admission decisions according to the established admission standards and criteria of the University and any applicable unit. The admission standards and criteria applied to applications submitted with the assistance or involvement of a recruitment agent or agency must be identical to those applied to applications submitted without the assistance or involvement of a recruitment agent or agency.

12) No recruitment agent or recruitment agency shall be contracted as an exclusive agent for the University or for any unit generally, or in a defined geographical area.

13) The University must not enter into a recruitment agreement to procure recruitment services for the purpose of recruiting students who are citizens or permanent residents of Canada or the United States of America or who are eligible to receive federal aid from the government of the United States of America.

**Mandatory Terms of Recruitment Agreements**

14) Any recruitment agreement must require any recruitment agent or recruitment agency that is a party to the recruitment agreement to comply with the following obligations:

a. Authorized agents and agencies must advise all applicants with whom they engage that applicants are not required to apply to the University through, or with the assistance of, any recruitment agent or recruitment agency.

b. An authorized agent or agency must not hold itself out as being able to offer applicants special or preferential access to the academic or non-academic programs or services of the University.

c. An authorized agent or agency must not hold itself out as being able to guarantee admission to the University or to guarantee an applicant authorization to enter Canada for the purpose of study.

d. Authorized agents and agencies must disclose the existence of compensation the authorized agent or agency receives for providing recruitment services from the University to applicants with whom they engage in the course of providing recruitment services to the University.

e. Authorized agents and agencies must not sub-contract recruitment services or any rights or obligations under any contract to provide recruitment services to any party without the written authorization of the University.

f. Authorized agents and agencies must not provide legal advice or representation to students regarding visas, study permits, or other matters relating to immigration to Canada unless the authorized agent or agency is legally permitted to do so.
g. *Authorized agents* and *agencies* must not engage in the recruitment of any student who is a citizen or permanent resident of Canada or the United States of America or who is eligible to receive federal aid from the government of the United States of America.

h. *Authorized Agents* must not hold themselves out as being employees or official representatives of the University except as specifically provided for in the *recruitment agreement*. 
Appendix B: Professional Master of Business Administration

FACULTY OF COMMERCE AND BUSINESS ADMINISTRATION

New program:
Professional Master of Business Administration

Revised program:
Master of Business Administration

New and revised courses
BA 501 (5) Professional Residency I: Leadership and Competitive Strategy;
BA 502 (5) Professional Residency II Business Development and Negotiations;
BA 503 (5) Professional Residency III: Ethics, Sustainability and Managing Change;
BAHR 560 (1.5) Building High Performance Teams and Organizations;
BAPA 560 (1.5) Foundations of Managerial and Business Economics;
BASC 525 (1.5) Supply Chain Strategy and Analytics;
BASM 514 (1.5) Strategy in Organizations

Appendix C: Awards Report

New Awards:

ASSOCIATION of BC Forest Professionals Sustainable Forest Management Prize – A $1,000 prize has been made available through an endowment established by ForesTrust, registered charity of the Association of BC Forest Professionals (ABCFP), for a Master’s student in the Faculty of Forestry studying sustainable forest management. Preference is given to students enrolled in the Master of Sustainable Forest Management program who have indicated the intent to become active members of the ABCFP during their career, and who have demonstrated academic excellence and leadership skills through their studies. The ABCFP is responsible for registering and regulating British Columbia’s professional foresters and forest technologists and is the largest professional association in Canada. The award is made on the recommendation of the Faculty of Forestry in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)

Mike CASSELMAN Field School Award – Awards totalling $1,000 are offered to third-year students enrolled in Field Geology (EOSC 328) at UBC’s Oliver-based Geological Field School. The awards honour the legacy of Mike Casselman, a passionate exploration geologist, brilliant mapper, and strong believer in valuing and preserving the environment along with finding a mineral resource. The award recipients will be chosen by a committee comprised of the Director of the Geological Field School and a minimum of two other Earth, Ocean and Atmospheric Sciences (EOAS) faculty members. The recipients will be chosen based on their academic performance during Field School, with preference given to those demonstrating a passion for mapping and a commitment to supporting their fellow students. The recipients will be identified after Field School is complete with disbursement of funds occurring in the fall. (First Award Available in the 2016/2017 Winter Session)

ENCHOR Graduate Scholarship in Choral Conducting – A $1,000 scholarship is offered
annually by members of Vancouver’s EnChor Choir, a 60 person mixed-voice choir created in 2007 by the late Dr. Diane Loomer to allow experienced singers age 55+ to enjoy high-quality singing. This scholarship is to be awarded to a graduate student in the Master of Music program who is excelling in the Choral Conducting program. The award is made on the recommendation of the School of Music in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)

**GRADUATING Class of Dentistry 2010 Award** – A $1,000 award is offered annually by the DMD class of 2010 to a student entering fourth year who has demonstrated a well-developed sense of clinical practice and academic skill in restorative dentistry. This award is in honour of Dr. Jim Richardson and his passion for and dedication to clinical teaching. The award is made on the recommendation of the Faculty of Dentistry. (First Award Available in the 2016/2017 Winter Session)

**Dr. Andrei KRASSIOUKOV International Autonomic Award** – Awards totaling $1,000 are offered annually by friends and family of Dr. Andrei Krassioukov, Chair in Rehabilitation Medicine, Associate Director and Scientist, International Collaboration on Repair Discoveries (ICORD), to undergraduate and graduate students, as well as post-doctoral fellows, fellows and medical residents. Through his career Dr. Krassioukov has focused on collaboration and research that include spinal cord injuries and rehabilitation. Being able to collaborate with colleagues with multidisciplinary areas of expertise is extremely important for success in repairing spinal cord injuries and research. This award is to recognize the research achievement of a recipient whose research in the area of Autonomic Dysfunctions is presented at a national or international level conference. The award is made on the recommendation of ICORD in the Faculty of Medicine and in the case of graduate students, in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2017/2018 Winter Session)

**MANZALAOUI Prize** – A $2,300 prize has been made available through an endowment established with a gift from the Estate of Mahmoud Aly Manzalaoui for a student who has excelled in a course in the language and/or literature of Middle English or Old English. Dr. Manzalaoui (1924-2015) was a scholar, teacher and friend to generations of students in Egypt, England and at the University of British Columbia. Those UBC students who took his course on Chaucer and other medieval topics will remember him for his lively classroom readings and informative lectures. He worked hard to impress on all of his students the importance of literature and its relation to life. The award is made on the recommendation of the Faculty of Arts, and in the case of a graduate student, in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)

**PROVINCIAL Court Judges’ Association Bursary** – Bursaries totalling $1,000 are offered annually by the Provincial Court Judges’ Association to students in financial need in the Peter A. Allard School of Law J.D. Program. The award is adjudicated by Enrolment Services. (First Award Available in the 2016/2017 Winter Session)

**Judith SALTMAN Prize** – A $1,000 prize is offered annually by friends and colleagues in honour of Judith Saltman to an outstanding student graduating from the Master of Arts in Children’s Literature (MACL). Professor Judith Saltman is recognized internationally as an expert on Canadian children’s literature. In her 33 years as a professor in the School of Library,
Archival and Information Studies (SLAIS), Judith championed one of the first interdisciplinary degrees by working with colleagues to establish the Master of Arts in Children’s Literature (MACL) and serving as Chair of the Program. The prize is assigned on the basis of academic merit and exceptional promise in the study of children’s literature. The award is made on the recommendation of MACL faculty members and SLAIS in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)

SINGLE Parents Bursary – Bursaries totalling $17,300 have been made available through an endowment established with a gift from the Estate of Phoebe Marjorie Hamilton. The bursaries are available to single parent students with demonstrated financial need. Ms. Hamilton (1916 – 2015) was a graduate of UBC (Bachelor of Physical Education 1966) and a resident of Victoria. She spent her long life teaching and learning in Canada, England, Europe and the United States. The award is adjudicated by Enrolment Services. (First Award Available in the 2016/2017 Winter Session)

UBC Faculty/Staff Centennial Scholars Major Entrance Award - A $4,100 renewable entrance award is offered annually through the generosity of UBC’s Faculty and Staff to an outstanding domestic student entering university directly from secondary schools, or transferring directly from other colleges and universities, in Canada or abroad. Criteria for this entrance award includes demonstrated academic and leadership achievements in the arts, community, athletics, or school. The recipient will be an academically qualified student with an interest in joining and contributing to the UBC Vancouver community but who would not be able to attend UBC without significant financial assistance. Candidates must be nominated by a member of their school or community. The award is made on the recommendation of the Centennial Scholars Entrance Award Committee. (First Award Available in the 2016/2017 Winter Session)

Previously-Approved Awards with Changes in Terms or Funding Source:

#689 Proposed Award Title and Description: Mary M. Young Global Citizen Award
Three awards valued at $12,600 each have been made available through an endowment established by Mary M. Young and The University of British Columbia. The award is offered to outstanding international students who would otherwise be financially unable to pursue post-secondary education. Preference is given to the students recruited through the United World College system. In addition to academic merit, consideration is given to qualities such as leadership skills, involvement in student affairs, or commitment to community service.

Rationale for Proposed Changes – Type of Action: this award has not been assigned for the past six years. It was the vision of the donor to have the award eventually opened up to include all international students, with preference given to the students recruited through the United World College system.

Previously-Approved Awards for Students with Disabilities

Rationale for Proposed Changes – Type of Action:
• Enrolment Services, in collaboration with Access and Diversity, has requested that the language of the following awards for students with disabilities be changed so as to bring the relevant calendar descriptions to 2016 standards.
• Enrolment Services proposes to remove language involving the administration of the
award (where to get the application, when it is due) as this causes confusion due to the change in deadlines and the names of offices, and the most up to date information can be included on the website rather than in the official description.

#629 Patricia Ann MACDONALD Memorial Scholarship
A $1,300 scholarship may be awarded either in total or in part to a blind or physically disabled student with a visual impairment or physical disability. The recipient must be in a program leading to a degree, with definite vocational goals and a high grade average. The scholarship is has been made available through an endowment established in memory of Patricia Ann Palmer Macdonald, who was born in Kaslo, attended Notre Dame University, Nelson and studied privately with several members of the UBC Music Faculty, earning three Music Conservatory degrees. She was an accomplished musician, singer, performer and a dedicated community worker and teacher of the blind, who was blind herself at birth. She passed away in April 1982 at the age of 36. The scholarship is intended to honour a student who exhibits some of Patricia Macdonald's qualities and talents. The award requires a special application which is available from the Office of Awards and Financial Aid, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#677 Judith C. THIELE Memorial Scholarship
A $2,400 scholarship for visually or physically disabled students with a visual impairment or physical disability has been made available through an endowment established endowed by family and friends in memory of Judith C. Thiele, B.A., B.L.S., co-founder and Reference & Collections Librarian, Crane Library and Resource Centre, UBC. Ms. Thiele was one of the very few totally blind professional librarians in North America, an educator, academic, researcher, internationally recognized expert on Braille transcription and special information technologies and community worker and activist on behalf of persons with disabilities. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities with preference given to a candidate who has been active in the area of community services. Application forms must be submitted by October 15 to the Awards and Financial Aid Office.

#1261 Elizabeth M. CRICHTON-CARVER Memorial Scholarship
A $100 scholarship has been made available through an endowment established by the late John A. Carver in memory of his mother, Elizabeth M. Crichton-Carver, for a student in the Faculty of Arts. Preference is given to disabled students with a disability. Financial circumstances of the candidate may be considered. The award requires a special application which is available from the Office of Awards and Financial Aid, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#1438 Dennet KUAN Memorial Award
Awards totalling $1350 have been made available through an endowment established endowed by Janet, Jennifer and Ryan Kuan in memory of Dennet Kuan (MBA, BSc) for undergraduate or graduate students with a physical disability in any year and faculty. The award was established as a reflection of Dennet's dedication to assisting people with a physical disability and to helping those who wish to continue their education. Dennet was a UBC alumnus who, in 2000, set up a UBC scholarship in memory of his father, Mann Kuan. When Dennet's son was born in 1992
with complex challenges, Dennet's "we can" attitude shaped and supported Ryan in facing their world. After a successful career in Forestry, Dennet made a career change. In his new career, he used his direct knowledge of the obstacles faced by individuals with a physical disability to help them and their families access a variety of equipment and assistive technology needs. Dennet passed away in 2009 at the age of 53. Students need a special application which is available from Enrolment Services, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#3512 Harriet Sarah BYRNE Scholarship
A scholarship of $700 has been made available through an endowment established in memory of Harriet Sarah Byrne. The award is intended to encourage a disabled student with a disability or a student demonstrating an interest and ability in the problems of individuals with disabilities. Preference is given to a woman undertaking studies in the health sciences. The award is adjudicated by the Committee on Awards for Students with Disabilities.

#7595 GRADUATING Class of 1970 Bursary
A $500 bursary, made available through an endowment established by the Graduating Class of 1970, is awarded to a student or students in any year and faculty. Special consideration will be given to those with physical disabilities. The award requires a special application which is available from the Office of Student Financial Assistance and Awards, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#7756 Leslie Anne WHITCUTT Memorial Bursary
A $600 bursary has been made available through an endowment established by her parents to provide financial assistance for blind students with a visual impairment who require special equipment related to their studies. The award requires a special application which is available from the Office of Awards and Financial Aid, the Crane Library and the Disability Centre. Applications must be submitted by October 15. Awards are made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#7861 Robert C. GIBSON Memorial Bursary
Bursaries totaling $950 have been made available through an endowment established in memory of Robert C. Gibson. The awards are made to assist disabled students with disabilities from rural areas and preference is given to visually impaired and/or physically handicapped students with a visual impairment or physical disability. The award requires a special application which is available from Enrolment Services and Access and Diversity. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#7864 Isabel G. MCMILLAN Bursary
Bursaries totaling $750 have been made available through an endowment established by Isabel G. McMillan, a member of the first graduating class at the
University of British Columbia, are offered to one or more students with sight handicaps visual impairments. The award requires a special application which is available from the Office of Student Financial Assistance and Awards, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

### #7867 Douglas T. KENNY Bursary for Disabled Students with Disabilities
Bursaries totalling $1000 are awarded to provide financial aid to disabled students with a disability. The funds have been made available through an endowment established provided by the Honourable Thomas A. Dohm, Q.C., LL.D., and are intended especially for those physically disabled students with a physical disability who need wheelchairs or other artificial aids to carry out their studies at the University. The award requires a special application which is available from the Office of Awards and Financial Aid, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

### #7980 Marion COPP Bursary
A bursary of $300 has been made available through an endowment established endowed by family and friends in memory of Marion Copp who for many years resided in northern B.C. and the Yukon. The award is made to students from rural areas and preference is given to visually impaired and/or physically handicapped students with a visual impairment or a physical disability. The award requires a special application which is available from the Office of Awards and Financial Aid, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

### #8028 BURRARD Charitable Foundation Bursary
A $850 bursary is offered annually by the Burrard Charitable Foundation, through funds administered by the Vancouver Foundation, for students with disabilities. Preference will be given to students with visual impairment. Adjudication is made by Enrolment Services. The award is adjudicated by the Committee on Awards for Students with Disabilities.

### #8044 PEO Sisterhood Chapter B Bursary For the Blind
Bursaries totalling $1,900 have been made available through an endowment established endowed by the PEO Sisterhood Chapter B in memory of Helen Mitchell and by the Estate of Hazel Lena Wilson in memory of John Mortimer Patrick, to assist blind students with a visual impairment. The bursary is awarded adjudicated by the Committee on Awards for Students with Disabilities.

### #8045 Steven VOLRICH Memorial Bursary
The members of the Law Class of 1984 have established a bursary of A $1,900 bursary has been made available through an endowment established by the members of the Law Class of 1984 in memory of their classmate, Steven Volrich. His classmates wish to honour the courage and undaunted spirit displayed by Steven in his battle with cancer. The bursary is awarded to a law student who requires financial assistance with preference given to a law student with a medical or physical disability. The award requires a special application which is available from the Office of Student Financial Assistance and Awards, the Crane Library and the
Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#8089 Cheryl MCKAY Bursary for the Visually Impaired
Bursaries totalling $800 have been made available through an endowment established with endowed through a bequest from Cheryl McKay. The awards are made to assist visually impaired students with a visual impairment. The award requires a special application which is available from the Office of Student Financial Assistance and Awards, the Crane Library and the Disability Centre. Applications must be submitted by October 15. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.

#8187 William Donald Mills AGNEW Memorial Bursary
Bursaries totalling $900 have been made available through an endowment established with endowed through a bequest from Doris Kinloch Agnew in memory of her husband William Donald Mills Agnew. The award is offered to students who are paraplegic or quadriplegic. Applications are available from the Office of Awards and Financial Aid and the Disability Resource Centre. The award is adjudicated by the Committee on Awards for Students with Disabilities.

#8313 Paul E. THIELE Bursary
Bursaries totalling $950 have been made available through an endowment established endowed for students with disabilities in recognition of Paul Thiele's thirty-two years of service to The University of British Columbia. Paul Thiele, along with his late wife Judith, was instrumental in the establishment of the Crane Library and Resource Centre, expanding it from a collection of Braille books to an internationally recognized library and support service for persons requiring print alternatives. Awards are made on the nomination of the Committee on Awards for Students With Disabilities. The award is adjudicated by the Committee on Awards for Students with Disabilities.

#8471 Lena ADAM Memorial Bursary for Students with Disabilities
Bursaries totalling $3,600 have been made available through an endowment established with endowed through a bequest from Lena Adam for students who have a physical disability and who demonstrate financial need. The award requires a special application which is available from the Office of Student Financial Assistance and Awards, the Crane Library and the Disability Centre. The award is made on the nomination of adjudicated by the Committee on Awards for Students with Disabilities.
To: Senate
From: Richard Anstee, Joint Faculties Senator
Re: Change to the Rules and Procedures of Senate

"That Senate amend its Rules and Procedures to add a new section to follow Section 29 to read as follows: Section 29 notwithstanding, any Senator appointed to a committee of Senate may ask –by giving written or verbal notice through the Secretary or the Committee Chair –that a matter proposed for approval by that committee under delegated authority of Senate be not considered under that delegated authority and instead be brought to Senate for approval. This section shall not apply to an appeal or otherwise confidential matter before a Committee."

Comment from Dr Anstee: While this does allow a single senator to cause such an item to come to Senate, it is unlikely to result in capricious items at Senate. I would point out that the various senate committees do already brings items approved at the subcommittee level to senate for approval, when the committees do not have delegated authority over the items. Some items are quite interesting, others less so. A senator, who feels that an item will have strong interest from Senate and is worthy of their attention, ought to be able to override the system of delegated authority in this case.

Comment from the Senate Agenda Committee: A motion similar to the above was referred to the Senate Agenda Committee at the last meeting. Dr Anstee met with us earlier this month to explain his rational for the proposed rule. The Committee appreciated Dr Anstee's perspectives, and highlighted a particular area of concern: the parenthetical clause allowing for a retroactive objection. Committee members felt that it would cause too much uncertainty if an action could only be tentatively approved until that one month period elapsed. After discussion with the Committee, Dr Anstee agreed to the removal of that clause, and thus the above motion is now proposed to you. The Senate Agenda Committee thanks Dr Anstee for his time and understanding.
4 November 2016

To: Vancouver Senate

From: Tributes Committee

Subject: Memorial Minutes

The Tributes Committee has prepared memorial minutes for the following individuals:

Dr. John Chapman
Dr. Myer Bloom
Dr. Robert Blake

Motion: That Senate approve the Memorial Minutes for Dr. John Chapman, Dr. Myer Bloom, and Dr. Robert Blake, that they be entered into the Minutes of Senate and copies be sent to the family of the deceased.

Respectfully submitted,

Dr. Sally Thorne, Chair
Senate Tributes Committee
Dr. John Chapman

Dr. John Chapman was born in Poole, in the United Kingdom, in 1923. He joined the Royal Air Force in 1942, serving as a flight instructor and as a member of the Tactical Air Force and Ferry Command. Following the war, he earned an MA in Geography at Brasenose College, Oxford, in 1947 and was appointed a Junior Instructor in Climatology at UBC in the same year. Dr. Chapman went on to earn a Ph.D. from the University of Washington.

Dr. Chapman was appointed a Junior Instructor in Climatology at UBC in 1947. In 1968, Dr. Chapman became the second person to be appointed Head of the Department of Geography, a post he held until 1974. His research interests included the climate of British Columbia, economic geography, and energy policy. Over the course of his distinguished career, he served as an Executive Member of BC Natural Resources, Chairman of the founding board of the Pacific Marine Institute, President of the Canadian Association of Geographers, Chair of the Pacific Science Congress, and Canadian Delegate to the Geographic Union Congress.

Dr. Chapman also played an important role in the development of the post-secondary education system in British Columbia, both at UBC and around the Province. In addition to his nine years as a Senator, he also served as UBC’s academic planner. Dr. Chapman was also selected to join a team established by the Provincial government to develop a plan for expanding post-secondary education within the Province. This group produced the influential Macdonald Report in 1962, leading to the creation of Simon Fraser University and the transition of Victoria College into the University of Victoria.

Dr. Chapman continued to play an important role in guiding British Columbia’s system of post-secondary education following his retirement from UBC in 1988. He served as a member of the Board of Vancouver Community College, Chair of the education committee of the BC Association of Colleges, Director of legislative committees for the BC Ministry of Education (Later the BC Ministry of Advanced Education), and Chair of the Academic Council for BC Open Learning. From 1990-93, Dr. Chapman played an important role in the founding of the University of Northern British Columbia, from which he later received an honorary LL.D.

In addition to his many academic achievements, Dr. Chapman also played a central role in Canadian field hockey. In addition to playing the sport, he was instrumental in the growth of the game in Canada, serving as President of the Canadian Field Hockey Association from 1972-74.

To his family and friends, the Senate and The University of British Columbia offer their condolences and thanks.
Myer Bloom

A pioneer in the field of Nuclear Magnetic Resonance, Dr. Myer Bloom was a member of the UBC Physics Department from 1956 until his retirement 1993. He served as a Senator for three years from 1966-1969.

Dr. Bloom was born in Montreal, Quebec in 1928. He received a B.Sc. in 1949 and an M.Sc. in 1950, both from McGill University, before completing his Ph.D. at the University of Illinois at Urbana-Champaign in 1954. From 1954-56, Dr. Bloom held a post-doctoral appointment at the Kamerlingh Onnes Laboratories at the University of Leiden.

First appointed to the Department of Physics at UBC as a research associate in in 1956, Dr. Bloom was appointed an assistant professor in 1957, an associate professor in 1960, and finally a full professor in 1963, a position he held for thirty years until his retirement. During his career at UBC, Dr. Bloom held a number of visiting professorships at institutions around the world, including Harvard University, Kyoto University, the University of Paris Sud, the University of Rome, and the Danish Technical University.

Dr. Bloom’s research focused on the field of Nuclear Magnetic Resonance. He made many important contributions to the field, including the first observation of free magnetic induction in pure quadropole resonance. Later in his career, Dr. Bloom shifted his focus to the application of Nuclear Magnetic Resonance to biological membranes, establishing the field of the physics of soft materials. He went on to become the founder and director of the Program on the Science of Soft Structures and Interfaces at the Canadian Institute for Advanced Research.

Throughout his career, Dr. Bloom received many prestigious awards and distinctions, including the Sloan and Guggenheim Fellowships, the Steacie Prize, the Gold Medal of the Canadian Association of Physics and the Canada Council Killam Memorial Prize for Natural Sciences. Dr. Bloom was a Fellow of the Royal Society of Canada, the American Physical Society and the Canadian Institute of Advanced Research. He has been awarded honorary degrees by Concordia University, and by the Technical University of Denmark.


To his family and friends, the Senate and The University of British Columbia offer their condolences and thanks.
Dr. Robert Blake

Having completed a B.Sc. at the University of Bristol and received his Ph.D. from the University of Cambridge, Dr. Robert Blake was appointed to the Department of Zoology in 1979 at the age of 25. He worked predominantly on integrating aspects of the biology of aquatic animals with biomechanics, and was an expert on fish locomotion, including the practical use of fish locomotory designs as biomimetic models for autonomous underwater vehicles.

Dr. Blake represented the Faculty of Graduate Studies as a Senator from 1999 until 2002, and was an active member of the Faculty Association, serving as its vice-president from 1994-1996, and as its president from 1996-1998. He was inducted to the Quarter Century Club in 2005, and retired in 2012.

To his family and friends, the Senate and The University of British Columbia offer their condolences and thanks.
4 November 2016

To: Senate

From: Academic Policy Committee

Re: Revisions to Graduate and Post-Doctoral Studies’ Academic Regulations

The Faculty of Graduate and Post-Doctoral Studies has forwarded revisions to the following aspects of its Academic Regulations sections of the Academic Calendar. The purpose of these revisions is to provide greater clarity with regard to Student Appeals on Academic Standing, Reviews of Assigned Standing, as well as student conduct and discipline.

The Committee has reviewed the proposed Calendar revisions and recommends the following:

**Motion:** “That Senate approve the proposed revisions to the Faculty of Graduate and Post-Doctoral Studies’ Academic Regulations sections of the Academic Calendar as set out in the attached forms.”

Respectfully submitted,

Dr. Paul G. Harrison, Chair
Senate Academic Policy Committee
**UBC Calendar Change Proposal Form**

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<th>Graduate and Postdoctoral Studies</th>
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<td>Effective Session (W or S):</td>
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<tr>
<td>Effective Academic Year:</td>
<td>now</td>
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<td>13 October 2016</td>
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<tr>
<td>Contact Person:</td>
<td>Larry Walker (Senior Associate Dean)</td>
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**Proposed Calendar Entry:**

**Academic Record**

**Transcript of Academic Record**

The transcript is a student’s official academic record and includes the student’s complete record at the University. Student records and transcripts are confidential and transcripts will be issued only at the request of the student or appropriate agencies or officials.

Apply for a transcript [online](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,204,342,619) through the Student Service Centre or in person Enrolment Services in Brock Hall. Please allow at least one week from the date the application is made. Transcripts will not be issued to students who have any outstanding fees, including library and other charges, to the University. Fees for transcripts are payable in advance; transcripts will not be provided until payment is received.

Students are encouraged to order transcripts as early as possible. Transcripts

**Present Calendar Entry:**

**Academic Record**

**Transcript of Academic Record**

The transcript is a student’s official academic record and includes the student’s complete record at the University. Student records and transcripts are confidential and transcripts will be issued only at the request of the student or appropriate agencies or officials.

Apply for a transcript [online](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,204,342,619) through the Student Service Centre or in person Enrolment Services in Brock Hall. Please allow at least one week from the date the application is made. Transcripts will not be issued to students who have any outstanding fees, including library and other charges, to the University. Fees for transcripts are payable in advance; transcripts will not be provided until payment is received.

Students are encouraged to order transcripts as early as possible. Transcripts
may be requested up to six months in advance of a due date.

Retention of Student Records

UBC academic records, including all information appearing on a Transcript of Academic Record, are retained indefinitely. Notations of student discipline are retained according to the terms of the penalty imposed. Materials supporting applications for admission, correspondence, and transcripts from other institutions and similar material may be destroyed five years after a student’s last registration, except for doctoral students, where materials may be destroyed after two years from the date of graduation. Other material may be destroyed sooner.

Students who submit irreplaceable material may request the return of that material. Such requests must be submitted with the original material. The office to which the material is submitted will return the material as soon as possible, and not later than six months after the student’s graduation or last registration.

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Students who submit irreplaceable material may request the return of that material. Such requests must be submitted with the original material. The office to which the material is submitted will return the material as soon as possible, and not later than six months after the student’s graduation or last registration.

Senate Appeals on Academic Standing

Students may protest decisions relating to their academic standing. Students should protest a decision first with the faculty member directly involved in the decision and then, if necessary, with the department head, the dean of the faculty involved, and finally with the Dean of the
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<th>Proposed Calendar Entry:</th>
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<td><strong>Academic Appeals</strong></td>
<td>Present Calendar Entry:</td>
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<tr>
<td><strong>Review of Assigned Standing</strong></td>
<td><strong>Academic Record</strong></td>
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Faculty of Graduate and Postdoctoral Studies.

The Committee on Appeals on Academic Standing is a standing committee of the University Senate, which is the senior academic authority in the University. Information on the policies and procedures of this committee can be found at [Senate Appeals on Academic Standing](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,204,342,619).

**Student Discipline**

The President of the University has the right under the British Columbia University Act, R.S.B.C., c. 468, s. 61, to take whatever disciplinary action is deemed to be warranted by a student’s misconduct. See [Student Conduct and Discipline](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,204,342,619) for specific provisions as to offences, penalties, and procedures.

**Type of Action:**
Delete the two sub-sections here under Academic Record (“Senate Appeals on Academic Standing” and “Student Discipline”), and move them to new sections under Academic Regulations (viz., “Academic Appeals” and “Student Conduct and Discipline,” respectively).
To appeal a grade in graduate-level coursework, see Review of Assigned Standing.

Senate Appeals on Academic Standing

Students may protest decisions relating to their academic standing. Students should protest a decision first with the faculty member directly involved in the decision, if applicable, and then, if necessary, with the graduate advisor or department head, and finally with the Dean of the Faculty of Graduate and Postdoctoral Studies.

The Committee on Appeals on Academic Standing is a standing committee of the University Senate, which is the senior academic authority in the University. Information on the policies and procedures of this committee can be found at Senate Appeals on Academic Standing.

Type of Action:

Create a new section under Faculties, Colleges, and Schools » Graduate and Postdoctoral Studies » Academic Regulations, immediately following “Examinations, Master’s Theses, and Doctoral Dissertations,” where it more appropriately belongs. Content is simply being moved from the sub-section within Academic Record, with minor clarifications.

Proposed Calendar Entry:

Student Conduct and Discipline

The President of the University has the right under the British Columbia University Act, R.S.B.C., c. 468, s. 61, to take whatever disciplinary action is deemed to be warranted by a student’s misconduct.

Type of Action:

Create a new section under Faculties, Colleges, and Schools » Graduate and Postdoctoral Studies » Academic Regulations, immediately following “Withdrawal, Reinstatement, and Readmission,” where it more appropriately
<table>
<thead>
<tr>
<th><strong>See Student Conduct and Discipline for specific provisions as to offences, penalties, and procedures.</strong></th>
<th>belongs. Content is being moved from the sub-section within Academic Record.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rationale for Proposed Change:</strong></td>
<td></td>
</tr>
<tr>
<td>Content is being reorganized in an attempt to provide greater clarity; thus the material found in the section on Academic Record pertains primarily to records retention, the material found in the section on Academic Appeals pertains to that topic (and now includes a link to the policy on Review of Assigned Standing), and the material found in the section on Student Conduct and Discipline pertains to academic misconduct.</td>
<td></td>
</tr>
<tr>
<td>Three clarifications have been provided in the sub-section on Senate Appeals on Academic Standing: (a) Not all evaluations of academic standing for graduate students occur within the context of coursework (e.g., comprehensive examinations) and so the injunction to begin the appeal with the faculty instructor is not always appropriate, hence the inclusion of the phrase, “if applicable.” (b) All graduate students are enrolled in a graduate program with a designated graduate advisor; however, not all graduate programs are encased within departments or schools (e.g., Neuroscience), hence the next step in the appeal process could be to either the graduate advisor or department head. (c) It is not appropriate for the disciplinary dean to be involved in the appeal process and that step has been deleted. The disciplinary faculty is not involved in evaluating graduate student progress and has no responsibility or authority in that</td>
<td></td>
</tr>
</tbody>
</table>
regard. The next step in the appeal process is to the Dean of the Faculty of Graduate and Postdoctoral Studies.
To: Vancouver Senate

From: Admissions Committee

Re:  
  a) Faculty of Graduate and Postdoctoral Studies: Admission – Doctoral Degrees (approval)  
  b) Use of BC First Nations Studies12 – Changes in Admission Requirements (approval)

---

a) Faculty of Graduate and Postdoctoral Studies: Admission – Doctoral Degrees (approval)(circulated)

The Committee has reviewed and recommends to Senate for approval changes in admission requirements for applicants to doctoral degree program in the Faculty of Graduate and Postdoctoral Studies. The proposal reduces the number of coursework credits, from 12 to 9, required for students transferring from a master’s to a doctoral program. The 9 required credits must be at the 500-level or above and all of first-class standing. The proposal also introduces a probationary requirement of completion of 12 credits with a first-class average in order to maintain registration in the doctoral program. Further, the proposal eliminates the requirement for direct entry applicants to present an honours bachelor degree for admission to the doctoral program. Finally, the proposal extends the time allowed to meet the probationary requirements for direct-entry students from one to two years.

*Motion*: That Senate approve changes in admission requirements for applicants to doctoral degree programs in the Faculty of Graduate and Postdoctoral Studies, effective for the 2016 Winter Session and thereafter.

---

b) Use of BC First Nations Studies12 – Changes in Admission Requirements (approval)(circulated)

The Committee has reviewed and recommends to Senate for approval the proposal to approve the use of BC First Nations Studies 12 to satisfy both the Social Studies 11 admission requirement and as an approved Grade 12 course that may be used in the calculation of an admission average. Currently, BC First Nations Studies can only be used to meet either the Social Studies 11 requirement or as an approved Grade 12 course. The use of BC First Nations Studies 12 to meet two admission requirements is consistent with other courses which can already be used to meet a Grade 11 and a Grade 12 requirement (e.g., Biology 12 to satisfy a Science 11 requirement and as an approved Grade 12 course, several approved Grade 12 language courses that can be used to satisfy the Language 11 admission requirement and as an approved Grade 12 course). Approval of the course to meet dual admission requirements also allows for greater flexibility in students’ use of the course and
aligns with the University’s strategic priorities on Aboriginal engagement.

**Motion:** that Senate approve the use of BC First Nations Studies 12 to satisfy the Social Studies 11 admission requirement and as an approved Grade 12 course for applicants following the BC/Yukon secondary school curriculum, effective for admission to the 2017 Winter Session and thereafter.

Respectfully submitted,

Dr. Robert Sparks  
Chair, Senate Admissions Committee
<table>
<thead>
<tr>
<th>Faculty:</th>
<th>Graduate and Postdoctoral Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department:</td>
<td>N/A</td>
</tr>
<tr>
<td>Faculty Approval Date:</td>
<td>13 October 2016</td>
</tr>
<tr>
<td>Effective Session (W or S):</td>
<td>2016W</td>
</tr>
<tr>
<td>Effective Academic Year:</td>
<td>2016W</td>
</tr>
<tr>
<td>Date:</td>
<td>13 October 2016</td>
</tr>
<tr>
<td>Contact Person:</td>
<td>Larry Walker (Senior Associate Dean)</td>
</tr>
<tr>
<td>Phone:</td>
<td>7-5546</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:lawrence.walker@ubc.ca">lawrence.walker@ubc.ca</a></td>
</tr>
</tbody>
</table>

**Proposed Calendar Entry:**

**Doctoral Degrees**

An applicant may apply for admission to the degree program by reviewing application requirements on the websites of the [graduate program](#) and the [Faculty of Graduate and Postdoctoral Studies](#), and completing the [online application](#) available on the Faculty of Graduate and Postdoctoral Studies website.

Students are normally admitted to study only in fields that are formally authorized by Senate to offer doctoral programs. All applications must be accompanied by an application fee at the time of submission. Consult the [Faculty of Graduate and Postdoctoral Studies](#) for current information on admissions and application fees.

The number of students that can be accommodated is limited and graduate programs will accept the best qualified students as vacancies occur. Most students begin their program of study at the start of the Winter Session (the beginning of September) but other start dates may be available, depending on the specific needs of the program.

**URL:** [http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,204,340,181](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,204,340,181)

**Present Calendar Entry:**

**Doctoral Degrees**

An applicant may apply for admission to the degree program by reviewing application requirements on the websites of the [graduate program](#) and the [Faculty of Graduate and Postdoctoral Studies](#), and completing the [online application](#) available on the Faculty of Graduate and Postdoctoral Studies website.

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The number of students that can be accommodated is limited and graduate programs will accept the best qualified students as vacancies occur. Most students begin their program of study at the start of the Winter Session (the beginning of September) but other start dates may be available, depending on the specific needs of the program.
available, depending on the specific program. Limitations on the number of students that can be accommodated require that applicants be selected well before the start date. Students are encouraged to submit applications for admission as early as possible.

Applicants for the Doctor of Philosophy (Ph.D.), Doctor of Musical Arts (D.M.A.) and Doctor of Education (Ed.D.) must have completed one of the following requirements prior to admission:

1. In the case of the Ph.D., a master’s degree (or equivalent) from an approved institution with clear evidence of research ability or potential, or in the case of the D.M.A., a master’s degree (or equivalent) from an approved institution with outstanding ability in performance or composition.

2. In the case of the Ed.D., a master’s degree in Education (or equivalent degree) from an approved institution.

3. A bachelor’s degree with one year of study in a master’s program with 9 credits at the 500-level or above and of first class standing. Students entering the doctoral program after partial completion of the master’s degree must, during the first two years of study at the graduate level, complete a total of 12 credits with a first-class average (of which at least 9 credits must be at the 500-level or above and at least 9 credits must be of first-class standing) to maintain registration as a doctoral student. Also:

   a. (for Ph.D.) clear evidence of research ability or potential;

   b. (for Ph.D., Elementary Education) first class standing in Teacher Training or a B.Ed.;

   c. (for Ed.D.) first class standing and first class standing in such prerequisite work as may have been
ability or potential;

b. (for Ph.D., Elementary Education) first class standing in Teacher Training or a B.Ed.;

c. (for Ed.D.) first class standing and first class standing in such prerequisite work as may have been required, and five years professional experience; or

d. (for D.M.A.) outstanding ability in performance or composition.

Transfer directly into a doctoral program is normally accomplished after completion of the first year of study at the master’s level and will not be permitted after completion of the second year.

4. In exceptional cases, applicants who hold an honours bachelor’s degree with an overall average in the A grade range and who demonstrate advanced research ability may be granted direct admission to a doctoral degree program on recommendation of the admitting graduate program and approval of the Dean of the Faculty of Graduate and Postdoctoral Studies. Students entering directly from a bachelor’s degree must, during the first year of study, complete 12 credits with a first class average, of which at least 9 credits must be at the 500-level or above and at least 9 credits must be of first class standing, to maintain registration as a doctoral student.

Individuals of Aboriginal ancestry are encouraged to apply. Additional information for Aboriginal applicants to graduate programs can be found on the Faculty of Graduate and Postdoctoral Studies website.

Students with Credentials from International Institutions

Applications for admission to doctoral
information for Aboriginal applicants to graduate programs can be found on the Faculty of Graduate and Postdoctoral Studies website.

**Students with Credentials from International Institutions**

Applications for admission to doctoral programs at UBC are welcomed and encouraged from students who hold a credential deemed comparable to a Canadian master’s degree and who demonstrate superior academic standing. Specific minimum admission requirements established by the Faculty for graduates of different countries may be found at Graduate Studies Admissions. These are minimum requirements; specific programs may have higher requirements.

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**Type of Action:**

This proposal modifies the requirements for students transferring from a master’s to a doctoral program by reducing the number of coursework credits from 12 to 9, but requiring that these 9 credits all be at the 500-level or above and all of first-class standing. It also introduces for these fast-track transfer students a probationary requirement (12 credits with a first-class average) for maintaining registration as a doctoral student.

For students directly entering the doctoral degree (without a master’s degree), the proposal eliminates the requirement that the bachelor’s degree used as the basis for admission be an honors degree. The proposal also extends the time allowed to meet the probationary requirement for direct-entry doctoral students from one to two years.

**Rationale for Proposed Change:**

The current requirement of an honors bachelor’s degree for direct entry into a doctoral program is an unnecessary obstacle for applicants who have superior...
academic records and demonstrated research ability, especially for those whose bachelor’s degree is from a North American university that does not offer an honors program.

The modification in the transfer and probationary requirements is intended to allow graduate students to make early progress in their research, to allow programs greater flexibility in their graduate course offerings, and to allow graduate students to take the most appropriate courses.
Admission Calendar Change Proposal Form

<table>
<thead>
<tr>
<th>Approval Date:</th>
<th>Date: September 2, 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Session:</td>
<td>Effective for the 2017 admission to UBC.</td>
</tr>
<tr>
<td>Year for change:</td>
<td>To be posted to the calendar upon approval for the purpose of advising prospective students.</td>
</tr>
<tr>
<td>Contact Person:</td>
<td>Celia Reimer Admissions Advisor, Undergraduate Admissions</td>
</tr>
<tr>
<td>Phone:</td>
<td>822-2558</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:celia.reimer@ubc.ca">celia.reimer@ubc.ca</a></td>
</tr>
</tbody>
</table>

Proposed Calendar Entry:

**Applicants Following the BC/Yukon Secondary School Curriculum > Admission Requirements**

Academic criteria are the primary basis for determining admissibility to UBC's Vancouver campus; however, many programs consider non-academic information as well. Academic averages for the purpose of admission to UBC's Vancouver campus are primarily based on Grade 12 final or in-progress course grades available in the spring; however, an applicant's full academic history (including grades for completed Grade 11 courses) may be considered, particularly where sufficient Grade 12 information is not yet available.

The minimum academic qualification for admission is secondary school graduation from a recognized secondary school, including the following Grade 11 and 12 courses:

<table>
<thead>
<tr>
<th>Grade 12</th>
<th>Required Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 12 or English 12 First Peoples</td>
<td></td>
</tr>
<tr>
<td>Three additional approved Grade 12 courses</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 11</th>
<th>Required Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 11 or English 11 First Peoples</td>
<td></td>
</tr>
<tr>
<td>Principles of Mathematics 11, Pre-Calculus 11, or Foundations of Mathematics 12</td>
<td></td>
</tr>
<tr>
<td>Civic Studies 11, Social Studies 11 or BC First Nations Studies 12</td>
<td></td>
</tr>
<tr>
<td>At least one approved Science 11</td>
<td></td>
</tr>
<tr>
<td>An approved Language 11</td>
<td></td>
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</tbody>
</table>

1. Or approved equivalent International Baccalaureate, Advanced Placement, or Post-secondary course. See the table [Specific Program Requirements for Applicants Following the BC/Yukon Secondary School Curriculum](#) and the sections titled [Advanced Placement and International Baccalaureate Courses Approved to Satisfy Pre-requisites](#) and [Post-Secondary Course Credits that Count Toward High School Graduation](#).

2. See the table [Specific Program Requirements for Applicants following the BC/Yukon Secondary School Curriculum](#) for programs requiring two Science courses at the Grade 11 level.

3. A beginner's Language 11 does not satisfy this requirement.
Present Calendar Entry:

URL from Web Calendar: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=2,22,63,0

Applicants Following the BC/Yukon Secondary School Curriculum > Admission Requirements

Academic criteria are the primary basis for determining admissibility to UBC's Vancouver campus; however, many programs consider non-academic information as well. Academic averages for the purpose of admission to UBC's Vancouver campus are primarily based on Grade 12 final or in-progress course grades available in the spring; however, an applicant's full academic history (including grades for completed Grade 11 courses) may be considered, particularly where sufficient Grade 12 information is not yet available.

The minimum academic qualification for admission is secondary school graduation from a recognized secondary school, including the following Grade 11 and 12 courses:

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<th>Grade</th>
<th>Required Courses¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 12</td>
<td>English 12 or English 12 First Peoples</td>
</tr>
<tr>
<td></td>
<td>Three additional approved Grade 12 courses¹,²</td>
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<tr>
<td>Grade 11</td>
<td>English 11 or English 11 First Peoples</td>
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<tr>
<td></td>
<td>Principles of Mathematics 11, Pre-Calculus 11, or Foundations of Mathematics 12</td>
</tr>
<tr>
<td></td>
<td>Civic Studies 11 or Social Studies 11²</td>
</tr>
<tr>
<td></td>
<td>At least one approved Science 11³</td>
</tr>
<tr>
<td></td>
<td>An approved Language 11⁴</td>
</tr>
</tbody>
</table>

¹ Or approved equivalent International Baccalaureate, Advanced Placement, or Post-secondary course. See the table Specific Program Requirements for Applicants Following the BC/Yukon Secondary School Curriculum and the sections titled Advanced Placement and International Baccalaureate Courses Approved to Satisfy Pre-requisites and Post-Secondary Course Credits that Count Toward High School Graduation.

² First Nations Studies 12 may be used either to satisfy the Civic/Social Studies 11 requirement or as an approved Grade 12 course for your admission average, but may not be used to satisfy both of these admission criteria.

³ See the table Specific Program Requirements for Applicants following the BC/Yukon Secondary School Curriculum for programs requiring two Science courses at the Grade 11 level.

⁴ A beginner's Language 11 does not satisfy this requirement.

Type of Action: Use First Nations Studies 12 to satisfy both the Social Studies 11 requirement and as an approved Grade 12-subject in the calculation of the admission average.

Rationale: First Nations Studies 12 is listed by UBC as an “Approved Grade 12 Course”. It is also approved by the Ministry of Education as one of the Social Studies 11 or 12 (4 credits)-required for
Students can use other grade 12 courses to satisfy two requirements (a grade 11 course requirement and a grade 12 course used in the admission average). Examples are: Biology 12 used in the calculation of an admission average and to satisfy a Science 11 when no other Science 11 presented; any number of approved language 12 courses used in the admission average and to satisfy the language 11 requirement when no language 11 presented. Also, all approved grade 12 courses are used to satisfy both grade 12 course requirements and used in the admission average (e.g. English 12, English 12 First Peoples, Pre-calculus 12, Chemistry 12, Physics 12).

Given that students must complete a Social Studies 11 or 12 for graduation (Dogwood Diploma) and the fact that one of UBC’s requirements is high school graduation, by virtue of graduating students have met UBC’s Social Studies 11/12 requirement.

Students having the ability to satisfy 2 requirements with one course would help greatly with the stress and course management of students’ final years of high school. If we could encourage students to take this route perhaps more students, Aboriginal and non-Aboriginal, would take BC FNST 12 and therefore learn more about the histories and legacies of BC’s indigenous people, an important piece of our Canadian history and social context.

The Truth and Reconciliation Commission has several calls to action for the k-12 curriculum, including:

62. We call upon the federal, provincial, and territorial governments, in consultation and collaboration with Survivors, Aboriginal peoples, and educators, to:

i. **Make age-appropriate curriculum on residential schools, Treaties, and Aboriginal peoples’ historical and contemporary contributions to Canada a mandatory education requirement for Kindergarten to Grade Twelve students.**

63. We call upon the Council of Ministers of Education, Canada to maintain an annual commitment to Aboriginal education issues, including:

i. **Developing and implementing Kindergarten to Grade Twelve curriculum and learning resources on Aboriginal peoples in Canadian history, and the history and legacy of residential schools.**

Allowing greater flexibility in students’ use of BC FNST 12 would align better with these goals.

**From BC Graduation Handbook:**

**Social Studies 10 and 11 or 12**

These courses help you understand the world and your place in it. You learn about events, issues and themes from the past and present. You also develop skills that help you think critically and become a responsible citizen. To graduate, you must complete a Grade 10 Social Studies course. You must also complete a Social Studies 11 or 12 course, such as Social Studies 11, Civic Studies 11 or BC First Nations Studies 12.

Course Description: **TRADITIONS AND HISTORY OF B.C.’S FIRST NATIONS PEOPLES. THIS COURSE FOCUSES ON THE RICHNESS AND DIVERSITY OF FIRST NATIONS LANGUAGES AND CULTURES WITHIN THEIR OWN CONTEXT; STUDIES THE**
Sophisticated, organized, self-sufficient societies of B.C. First Nations; explores First Nations art as a total cultural expression; develops an awareness of human rights and freedoms as they pertain to First Nations; develops an understanding of and appreciation for First Nations values and beliefs.
7 October 2016

From: Senate Awards Committee

To: Senate

Re: New Awards and Changes to Existing Awards (September 2016)

The Senate Awards Committee recommends:

“That Senate accept the awards as listed and forward them to the Board of Governors for approval; and that letters of thanks be sent to the donors.”

New Awards

**Glenn and Annetta AGNEW Bursary in Computer Science** – Bursaries totalling $4,000 are offered annually by the Glenn and Annetta Agnew fund, managed by the Vancouver Foundation, for undergraduate or graduate students in computer science or computer engineering who demonstrate financial need. The award is adjudicated by Enrolment Services. (First Award Available in the 2017/2018 Winter Session)

**Glenn and Annetta AGNEW Bursary in Medicine** – Bursaries totalling $4,000 are offered annually by the Glenn and Annetta Bursary fund, managed by the Vancouver Foundation, for MD students who demonstrate financial need. The award is adjudicated by Enrolment Services. (First Award Available in the 2017/2018 Winter Session)

**Glenn and Annetta AGNEW Science Co-op Award** – Awards totalling $4,000 are offered annually by the Glenn and Annetta Agnew fund, managed by the Vancouver Foundation, for Science Co-op students who demonstrate leadership in the UBC Science community or with their employer, and who have demonstrated financial need. The award is made on the recommendation of the Faculty of Science in consultation with Enrolment Services. (First Award Available in the 2017/2018 Winter Session)

**Dr. Alexander C. E. AYLETT Graduate Research Award in Environmental Studies** – A $1,000 award is offered annually by friends and family in memory of Dr. Alexander C. E. Aylett (UBC MA 2004, PhD 2012). This award recognizes an outstanding graduate student in the fields of human geography or environmental geography whose work focuses on sustainable urban development. Financial need may also be considered. The award is made on the recommendation of the Department of Geography in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)
Peter BRUNOLD Award of Excellence in Business – A $5,000 award has been made available through an endowment established by Peter Brunold for an undergraduate student enrolled in the Bachelor of Commerce degree program in the Sauder School of Business. The award is for a student who has demonstrated academic excellence, is on the Dean’s Honour Roll, and who would not be able to pursue a degree program without financial support. Preference will be given to a student with demonstrated leadership ability and involvement in the community. To be considered, candidates must be Canadian Citizens or Permanent Residents. The award is made on the recommendation of the Sauder School of Business in consultation with Enrolment Services. (First Award Available in the 2017/2018 Winter Session)

FREEDOM 55 Financial Fitness & Community Wellness Award – Two awards of $2,500 each, are offered annually to students in 3rd year or a higher year of study with good academic standing, who demonstrate leadership and who are on a varsity athletic team. This award may be renewed provided the students maintain good academic standing and continue to be varsity athletes. The award is made on the recommendation of UBC Athletics. (First Award Available in the 2016/2017 Winter Session)

Neil FREEMAN Memorial Scholarship – A $1,000 scholarship is offered annually by Julie Stockton in memory of her husband, Neil Freeman. Professor Emeritus Neil Freeman taught in the Department of Theatre and Film from 1991 to 2006. He was renowned for his unique approach to the unlocking of Shakespearean text for young actors. Students always left his classes with a new respect for Shakespeare and new insights in how to decipher the mysteries of the Bard. His research into the First Folio and his writing on the use of these texts for the actor changed the way Shakespeare is approached by thousands of actors around the world. The scholarship is given to an undergraduate or graduate student in theatre who shows exceptional aptitude for Shakespeare or advancement of Shakespearean research. The award is made on the recommendation of the Department of Theatre and Film and, in the case of a graduate student, in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)

Murdoch Angus NICHOLSON Memorial Bursary in Medicine – A $1,000 bursary has been made available through an endowment established by Elizabeth Nicholson and Allan Nicholson in memory of their father, Murdoch Angus Nicholson, for students in Medicine. Dr. Nicholson left school at 14 to work on the family farm but his sister encouraged him to finish high school and steered him in the direction of her vocation, teaching. After several years in that profession, he decided to go to university and found his passion - Medicine. He loved the daily challenge of diagnosing illnesses from often vague symptoms, of prescribing new drugs to previously untreatable diseases, and of learning about all the new advances in his field. He particularly enjoyed practicing in small communities as he was able to offer his patients everything from obstetrics to pathology. After graduating from the University of Toronto, he practiced in rural areas of Ontario before serving overseas during World War 2. During his basic training in
Vernon, he discovered Vancouver and moved there in 1946 where he practiced for almost 30 years. This bursary is proudly offered in his memory. The award is adjudicated by Enrolment Services. (First Award Available in the 2017/2018 Winter Session)

PLANT a Seed & See What Grows Foundation Bursary in Land & Food Systems – A $1,000 bursary is offered annually by the Plant a Seed & See What Grows Foundation to support an undergraduate student pursuing a BSc in Land & Food System’s Food and the Environment program. Plant a Seed & See What Grows Foundation has created this award in support of their vision to strengthen the community’s capacity to create a healthier generation through experiences that connect to the land and provide opportunities to improve our communities. The award is adjudicated by Enrolment Services. (First Award Available in the 2017/2018 Winter Session)

Sam RATTAN Suicide Awareness Award – A $1,000 award is offered annually in honour of Sam Rattan to an outstanding student in the Master of Social Work program who has a demonstrated interest in mental health education and developing both critical and creative responses to assist efforts to address mental health distress and suicidal ideation/suicide. Sam Rattan was a bright 23-year-old who suffered from mental illness from his teenage years and ultimately succumbed to his illness by suicide. During this time, Sam’s family encountered a lack of resources and education to support family members/friends in understanding mental illness so that they could help their loved one. To be considered, candidates must demonstrate community involvement, direct practice, and/or volunteer work with a specific focus on assisting patients and families to navigate the health system. The award is made on the recommendation of the School of Social Work, in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)

UNITED Nations Association of Canada MPPGA Young Professional Award – An award of $2,500 will be given to the candidate(s) nominated by the Master of Public Policy and Global Affairs (MPPGA) program to participate in the United Nations Association of Canada International Development and Diplomacy Internship program (IDDIP). Students will be selected based on their academic achievements, their readiness to work abroad, and their expertise related to roles in the IDDIP. The award will be distributed upon successful signing of a Host Organization placement contract through the United Nations Association of Canada. The award is made on the recommendation of the Graduate Committee of the MPPGA in consultation with the Faculty of Graduate and Postdoctoral Studies. (First Award Available in the 2016/2017 Winter Session)

Maili WONG Award in Finance – A $2,000 award is offered annually by Maili Wong for an outstanding undergraduate student enrolled in the Bachelor of Commerce degree program in the Sauder School of Business with specialization in Finance. This award is to recognize the competitive nature and the caliber of students who apply to the Sauder Portfolio Management Foundation Program but are not admitted to the program. Preference will be given to a female
student who has shown strength in the face of adversity, upholds the values of honesty and integrity, and shows commitment to both personal and professional growth. (First Award Available in the 2016/2017 Winter Session)

UBC Vantage College Excellence Bursary (tuition) - Bursaries ranging in value up to the full annual cost of the student’s academic program tuition and fees are offered upon recommendation by the International Student Initiative to continuing international undergraduate students who were previously awarded the UBC Vantage College Excellence Award and continue to demonstrate financial need but do not meet the Senate’s criteria for a continuing award based on academic merit. The value of each bursary will depend on the applicant's financial circumstances. The bursary may be renewed for up to three additional years of undergraduate study or to degree completion, whichever is less, provided the recipient remains an international student on a valid Canadian study permit. Bursary recipients will have their situations reviewed annually by their Faculty as well as Enrolment Services regarding both academic progress and financial need.

UBC Vantage College Excellence Bursary (living costs) - Bursaries ranging in value up to the full cost of the student’s living costs are offered upon recommendation by the International Student Initiative to continuing international undergraduate students who were previously awarded the UBC Vantage College Excellence Award and continue to demonstrate financial need but do not meet the Senate’s criteria for a continuing award based on academic merit. The value of each bursary will depend on the applicant's financial circumstances. The bursary may be renewed for up to three additional years of undergraduate study or to degree completion, whichever is less, provided the recipient remains an international student on a valid Canadian study permit. Bursary recipients will have their situations reviewed annually by their Faculty as well as Enrolment Services regarding both academic progress and financial need.

Previously-Approved Awards with Changes in Terms or Funding Source:

#1678
Present Award Title and Description: Lorraine DOUGLASS Prize in Real Estate Law – Prizes totalling $850 have been endowed for students who have obtained high academic standing in any course or seminar in Real Estate Law with preference given to those students who have demonstrated excellence in condominium law. The awards are made on the recommendation of the Faculty of Law.

Proposed Award Title and Description: Lorraine DOUGLASS Prize in Condominium Law – A maximum of two prizes totalling $850 have been made available through an endowment for students who have demonstrated academic excellence in the Peter A. Allard
School of Law’s Condominium Law course (Law 442). The awards are made on the recommendation of the Peter A. Allard School of Law.

Rationale for Proposed Changes – Type of Action: upon the donor’s request, and in compliance with the donor’s original intentions to support students’ academic excellence in Condominium Law, we are changing the award title and award eligibility criteria accordingly.

Present Award Title and Description: International Undergraduate Students Short-Term Bursary Fund – Bursaries ranging in value up to the full cost of the student’s living costs are offered by the University of British Columbia to continuing international undergraduate students who demonstrate financial need. The value of each bursary will depend on the applicant’s financial circumstances. (First Award Available in the 2016/2017 Winter Session)

Propose Award Title and Description: International Undergraduate Students Short-Term Bursary – A limited number of bursaries are offered to continuing international undergraduate students who demonstrate significant and unanticipated, but short-term financial need. The value of each bursary will depend on the applicant’s financial circumstances. Financial need assessments and the determination of a student’s eligibility for the short-term bursary are undertaken by Enrolment Services in consultation with the International Student Initiative. (First Award Available in the 2016/2017 Winter Session)

Present Award Title and Description: International Undergraduate Students Long-Term Bursary Fund: Bursaries ranging in value up to the full cost of the student’s program and living costs are offered by the University of British Columbia to continuing international undergraduate students who demonstrate financial need. In order to be eligible for bursary consideration, students must be in good academic standing. Preference in the selection of recipients will be given to students who also demonstrate engagement within the UBC community. The value of each bursary will depend on the applicant’s financial circumstances. The bursary may be renewed for up to three additional years of undergraduate study or to degree completion, whichever is less, provided the recipient remains an international student on a valid Canadian study permit. Bursary recipients will have their situations reviewed annually by their Faculty as well as Enrolment Services regarding both academic progress and financial need. (First Award Available in the 2016/2017 Winter Session)

Proposed Award Title and Description: International Undergraduate Students Long-Term Bursary – A limited number of bursaries ranging in value up to the full cost of the student’s academic program and living costs are offered to continuing international undergraduate students who demonstrate a significant, unanticipated change in their financial circumstances, rendering them unable to continue their studies at UBC. In order to be eligible for bursary consideration, students must be in good academic standing. Preference
in the selection of recipients will be given to students who also demonstrate engagement within the UBC community. The value of each bursary will depend on the applicant’s financial circumstances. The bursary may be renewed for up to three additional years of undergraduate study or to degree completion, whichever is less, provided the recipient remains an international student on a valid Canadian study permit, shows academic progress as determined by their Faculty, and continues to demonstrate financial need. Bursary recipients will have their situations reviewed annually. Financial need assessments and the determination of a student’s eligibility for the long-term bursary are undertaken by Enrolment Services in consultation with the student’s Faculty and the International Student Initiative. (First Award Available in the 2016/2017 Winter Session)

Rationale for Proposed Changes – Type of Action: These revisions more accurately reflect the nature of the financial need eligible students will present as well as the approach the university will undertake to assess this financial need. The phrase “a limited number” has been added to each description to accurately reflect the fact that there is a limited amount of funding available for undergraduate international student awards and bursaries and that these students are not eligible for the guarantees Policy 72 provides domestic students. For the long-term bursary which is renewable, greater detail has been added to outline the conditions for renewing the bursary.
16 November 2016

To: Vancouver Senate

From: Senate Curriculum Committee

Re: November Curriculum Proposals (approval)

The Senate Curriculum Committee has reviewed the material forwarded to it by the faculties and encloses those proposals it deems as ready for approval.

The following is recommended to Senate:

**Motion:** "That the new course brought forward by the Faculty of Graduate and Postdoctoral Studies (Medicine) be approved."

Respectfully submitted,

Dr. Peter Marshall, Chair

Senate Curriculum Committee
FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

New course

Medicine

MEDI 503 (3) Introduction to Clinical, Patient Oriented and Translational Research
UBC Curriculum Proposal Form
Change to Course or Program

<table>
<thead>
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<th>Category: 1</th>
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**Faculty:** Medicine  
**Department:** Medicine  
**Faculty Approval Date:**  
**Effective Session (W or S):** W  
**Effective Academic Year:** 2016

**Date:** February 15, 2016  
**Contact Person:** Vince Duronio  
**Phone:** (604) 875 - 4707  
**Email:** vduronio@mail.ubc.ca

**URL:**  
http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&code=MEDI

**Present Calendar Entry:**  
N/A

**Type of Action:**  
Create a new Course

**Rationale for Proposed Change:**  
The course is being proposed to support the growing number of Experimental Medicine graduate trainees who are executing research projects which involve some component of clinical (alternative therapy or treatments), patient oriented and translational research. The program has been developed to reflect this growing stream of projects within the Experimental Medicine program umbrella for which no current course exists within the program. The goal of this course is to provide a base level of knowledge for these students coming into the program, many of whom have never worked with human subjects, and encourage them to identify areas for future educational opportunities within their chosen project areas. The course is designed to provide a high level big picture of key components such as framing appropriate research questions, appropriate research designs, basics of biostatistics, protocol development, key concepts in regulatory approval and human ethical oversight in Canada, privacy and knowledge translation. The proposed design has been tested in Fall 2015 with a small group of pilot students. Student feedback was collected for each module, and changes to the curriculum were made based on the experience of learners, TAs and instructors.

**Prerequisites:**  
Permission of Experimental Medicine Program Director

**Rationale for not being available for Cr/D/F grading:**  
(undergraduate courses only)

**Rationale for not being available for Pass/Fail or Honours/Pass/Fail grading:**  
N/A
16 November 2016

To: Vancouver Senate

From: Senate Curriculum and Admissions Committees

Re: Bachelor of Applied Science in Biomedical Engineering (approval)

The Senate Curriculum and Admissions Committees have reviewed the material forwarded to them by the Faculty of Applied Science and enclose those proposals they deem ready for approval.

The following is recommended to Senate:

**Motion:** “That the new Bachelor of Applied Science in Biomedical Engineering degree program and its associated new courses be approved.”

Respectfully submitted,

Dr. Peter Marshall, Chair, Senate Curriculum Committee
Dr. Robert Sparks, Chair, Senate Admissions Committee
FACULTY OF APPLIED SCIENCE
New program and its associated new courses
Bachelor of Applied Science in Biomedical Engineering; BMEG 101 (3) Introduction to Biomedical Engineering; BMEG 102 (2) Biomedical Engineering Lab; BMEG 150 (4) The Fundamental Units of Life: From Cells To Systems; BMEG 201 (3) Technical Communication for Biomedical Engineers; BMEG 210 (2) Thermodynamics in Biomedical Engineering; BMEG 220 (4) Circuits and Electromagnetics with Application to Biomedical Engineering; BMEG 230 (4) Biomechanics I; BMEG 250 (4) Cellular Physiology and Biophysics; BMEG 257 (4) Biomedical Engineering Design I; BMEG 310 (3) Introduction to Bioinformatics; BMEG 320 (3) Bioengineering Feedback Systems and Controls; BMEG 330 (3) Biomechanics II; BMEG 350 (4) Human Structure/Function from Cells to Systems; BMEG 357 (3) Biomedical Engineering Design II; BMEG 370 (3) Cellular Responses to Forces and Biomaterials; BMEG 371 (3) Transport Phenomena within Cells and Tissues; BMEG 372 (3) Biomedical Materials and Drug Delivery; BMEG 373 (3) Microfluidics; BMEG 390 (3) Medical Imaging; BMEG 430 (3) Economics of Healthcare Solutions; BMEG 450 (6) Biomedical Engineering Design Project; BMEG 474 (3) Stem Cells and Regenerative Medicine
The University of British Columbia

Faculty of Applied Science

New Program Proposal
Bachelor of Applied Science
in Biomedical Engineering

2016-10-06

APSC FACULTY APPROVAL DATE
October 27, 2016

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1 This program is designed with the intent to deliver the program in a proposed School of Biomedical Engineering jointly housed in the Faculty of Applied Science and the Faculty of Medicine
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EXECUTIVE SUMMARY

Overview
The University of British Columbia is a comprehensive research-intensive university, consistently ranked among the 40 best universities in the world. Its Faculties of Medicine and Applied Science are internationally recognized. This proposal draws on that renowned expertise and defines a new program for Bachelor of Applied Science students to pursue a Canadian Engineering Accreditation Board (CEAB) accredited Biomedical Engineering (BME) degree in Vancouver. Labour market demand for Biomedical Engineers and the potential for expansion of the industry in BC is well documented and growing. Students will apply directly to the BME program when applying to UBC engineering.

Biomedical Engineering addresses fundamental problems where human biology and physical design principles intersect. The program will give the next generation of biomedical engineers the critical thinking and practical skills needed for scientific discoveries and inventions that promote health. The BME program is both comprehensive and broad and includes four streams of specialization. Our Biomedical Engineers will be in demand in a variety of diverse contexts and environments including government agencies, medical research facilities, manufacturing and health services industries.

Biomedical Engineering has become a major field of engineering. Most large Universities provide BME training, often as an option or sub-specialty within another engineering discipline. Some have stand-alone BME Departments. UBC’s BME options (within Mechanical and Electrical & Computer Engineering) are neither sufficiently broad to supply the biomedical technology sector, nor do they provide comprehensive preparation needed for development, commercialization and research careers.

Credential
The credential awarded will be the Bachelor of Applied Science (B.A.Sc.) in Biomedical Engineering. It is expected to be CEAB accredited.

Location
The Vancouver Campus of UBC and the UBC/Vancouver Hospital site are the main locations for classroom education and administration.

Faculties Offering Program
This current document proposes that the program be offered and administered by the Faculty of Applied Science. A proposal for a new School of Biomedical Engineering is being developed and submitted in parallel to this program proposal. The Faculty of Medicine and the Faculty of Applied Science would jointly administer the School. The intention is that if the proposal for the School of Biomedical Engineering is approved, once the School exists as an academic unit with the authority to offer educational programs, the Bachelor of Applied Science in Biomedical Engineering (and other related graduate programs) will be offered within the School. Prior to the approval and creation of the school, and in the absence of approval for the School, the program will reside and be administered in the Faculty of Applied Science. Course instruction will be
offered through the Faculty of Applied Science, the Faculty of Medicine and the Faculty of Science which already delivers a number of first year courses in Engineering programs.

Program Start Date
Subject to approval, a pilot program will begin in May 2017. A select group of 25 students who finished their common engineering first year in April 2017 will have access to the summer courses that form part of the new program and will form the pilot cohort for the rest of the program. Specifically, they will be able to take BMEG 101 and 102. These students will also have taken APSC 101, PHYS 159 and ENGL 112 in the standard first year time table. For this pilot only, we will make special arrangements for the students to take BMEG 150 as well as the second chemistry course. Pilot students will enter their second year of the BME specific pilot program in September 2017. September 2017 will also see the enrolment of the first full 100 student BME cohort into first year engineering. Resources have been committed by APSC and the FOM to commence the program with a 25 student cohort.

Program Completion Time
Completion of the 153 Credit program is expected to require eight four-month terms and one six-week term of full-time academic study. Additionally, cooperative education experiential learning placements are an integral part of the Bachelor of Applied Science in the Biomedical Engineering program. Students will typically complete four 4-month experiential learning placements coordinated through the Applied Science Co-op Program. Work terms can take place during the Winter or Summer terms. Students should refer to the program website for the current schedule. Participation in the cooperative education experiential learning placements will extend the completion time to just under 5 years.

Goals of the Program
The Biomedical Engineering program will:

- Develop uniquely qualified, solution-driven biomedical engineers with critical thinking and practical skills needed to support innovation through research, technology transfer and creation of spin-off companies, translating medical research into products and services, improving healthcare solutions in major areas of human disease;
- Promote Canada/BC as a leader in the Global knowledge economy;
- Fill current and future job gaps in BC’s growing biotechnology sector;
- Offer a project-based curriculum preparing students well for graduate, research and professional studies, medical school, industry employment, and entrepreneurial opportunities; and
- Help UBC emerge as a leading institution in BME.

Contribution to UBC’s Mandate and Strategic Plan
The BME program aligns with the strategic plan and will enhance the profile of the Faculty of Applied Science, the Faculty of Medicine and the University. The BME program will offer an exceptional learning environment for students, attract students from around the world, and be in demand across the globe. It will call upon and enhance its expertise and reputation in both engineering and medicine to develop graduates uniquely prepared to support innovation and improve healthcare solutions in major areas of human health and disease.
**Delivery Methods**
Required and elective courses address core concepts, skills and graduate attributes in Biomedical Engineering. Courses include traditional, online and “mixed” instruction, laboratory and design work. In a final Capstone project students design and build a product under mentorship of university and/or industry experts. The normal path of study includes 4 terms (4 months each) of relevant work experience coordinated through the Applied Science Co-op Program. Eligible students may participate in the *Coordinated International Experience* Exchange program for opportunities for internships and/or study internationally.

**Program Learning Outcomes**
Graduates of the Biomedical Engineering program will be able to:

- Formulate, model and understand – through analysis and experimental work – biomedical engineering problems through the application of insights and techniques from the physical sciences, biology, engineering and mathematics.
- Design, in collaboration with medical doctors and life scientists, appropriate technologies, performance metrics, and validation methods that address problems at the interface between engineering and medicine and improve human health.

**Linking Learning Outcomes and Curriculum Design, Optional Work-terms**
The number and variety of courses available to students is purposely limited to ensure a robust and streamlined learning experience centered on the program learning outcomes. The scope of the learning outcomes is broad and many educational experiences are designed to ensure they are met. Each learning outcome is a core driver of the courses in the program. Work and research experience are important features of the experiential learning work placements contributing to meeting the learning outcomes. The capstone project brings the course-work and practical learning together to demonstrate that key Program Learning Outcomes were achieved.

**Program Strengths**
The program offers a comprehensive curriculum grounded in foundational principles of engineering science. The program was developed interprofessionally drawing upon expertise within Applied Science (chemical and biological; electrical and computer; mechanical; and materials engineering departments), Faculty of Medicine and the Faculty of Science. Consultation with the Faculty of Pharmaceutical Sciences was also used to shape this proposal. In addition to the BME core, the program includes engineering design, molecular biology, mechatronics and pre-med foci. Students will also have training in communications, and opportunities for electives in humanities. Students will be qualified for accreditation as professional BME engineers, and well prepared for graduate studies, medical school, and careers in industry and entrepreneurship.

**Related Programs at UBC or other BC Post-secondary Institutions**
The program curriculum includes pre-existing UBC courses as well as 22 new courses. In addition to UBC’s BME options, these are the related programs in BC:

<table>
<thead>
<tr>
<th>UBC</th>
<th>Proposed</th>
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<tbody>
<tr>
<td>Is not a subset of another engineering program: Accredited as a BME program. Robust BME content: 15 core and 10 elective BME specific courses beginning in 1st year.</td>
<td></td>
</tr>
</tbody>
</table>
**UBC** | **Option in Mechanical or Electrical and Computer Engineering**
---|---
Subset Option within the Electrical and Computer Engineering Program. Insufficiently broad and comprehensive for development and research in many BME fields.

**UBC & BCIT Joint** | **Honours Bachelor of Science in Biotechnology**
---|---
Four year, 132 Credit Science program with 2 Years study at BCIT; two 4-month Co-op. Not an engineering program.

**University of Victoria** | **Biomedical Engineering**
---|---
Students specialize in either Electrical or Mechanical BME, with further specialization using technical electives. Relatively small number (5) of core/mandatory BME-specific courses and (5) BME-specific electives and no 1st year BME courses. Currently not accredited as a BME program. Accreditation anticipated in the fall 2016\(^2\)

**SFU** | **Biomedical Engineering Option**
---|---
Curriculum has substantial overlap with other engineering programs. Relatively small number of mandatory BME-specific courses only starting in 3rd year. Jointly offered by Physiology & Kinesiology, not Medicine. Not accredited as BME

**BCIT** | **Biomedical Engineering Diploma**
---|---
Two years; five week practicum
Specific to the medical devices industry.

**Institutional Contact**
University of British Columbia
Faculty of Applied Science
Elizabeth Croft, Associate Dean, Education & Professional Development elizabeth.croft@ubc.ca
604-822-6614

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\(^2\) At the time of our submission to UBC Senate for approval, accreditation had not yet been achieved.
APPENDIX A: Appendix to the Executive Summary (for internal UBC purposes only)

Budget and Funding
The signed Budgetary Impact Form is included in the proposal package.

A financial proposal has been prepared by the Applied Science and the Faculty of Medicine business officers for the BME program and for the School of Biomedical Engineering for review by the Provost Office and also for consultation with Science and other academic units.

This program will follow the same tuition model as other existing UBCV B.A.Sc. programs. These programs assess tuition on a per-credit basis. Current rates are published on the UBC website: http://students.ubc.ca/enrolment/finances/tuition/undergraduate-tuition-fees. See Appendices for Tuition and Fee Assessment Details.

This program will share the majority of the common first year of our existing Vancouver-based B.A.Sc. programs. Additionally, a number of the courses for the BME program, both core and elective, will be pre-existing courses. New BME courses are being proposed within this proposal. Syllabi for new courses are included at the end of this proposal.

Additional resources are required to manage and provide this program. These resources are included as part of the separate and special funding proposal for the expansion of Applied Science.

Space Requirements
Current classroom space within the Faculty of Applied Science will be insufficient for the program. The program will enroll 100 new students each year beyond what APSC currently enrolls (an approximately 10% increase) and new courses will require space. At steady-state, there will be between 400 and 500 new undergraduates in this program and expectations are that the number of graduate students will also increase. During the ramp-up of the program Applied Science and Medicine will work together to jointly and effectively utilize teaching space at the Vancouver Hospital site and laboratory space in the Biomedical Research Centre.

A proposal for a new Biological and Environmental Engineering Building has been received for Executive Review and Approval (Exec 1) and is scheduled for Board 1 review for summer 2017. This facility will meet our growing laboratory, classroom and administrative needs.

Library
The new courses for this program have been reviewed by the library and the signed Library consultation form is included in the proposal package. The courses requiring new resources will be funded by the APSC Dean’s Office.
1. Introduction
The University of British Columbia consistently ranks among the 40 best comprehensive research-intensive universities in the world. It creates an exceptional learning environment that fosters global citizenship, advances a civil and sustainable society, and supports outstanding research to serve the people of British Columbia, Canada and the world. Since 1915, UBC's West Coast spirit has embraced innovation and challenged the status quo. Its entrepreneurial perspective encourages students, staff and faculty to challenge convention, lead discovery and explore new ways of learning. It is recognized for its expertise in, among other things, its Faculties of Medicine and Applied Science. This proposal defines a new program that will continue that tradition of innovation and discovery and has the potential to advance UBC’s and BC’s reputation and influence in the growing field of Biomedical Engineering (BME).

Prospective and current students frequently ask about the availability of a BME program. Industry and market reports describe a growing need for engineers with biomedical training. This proposal defines a new program for Bachelor of Applied Science students at UBC to pursue a Canadian Engineering Accreditation Board (CEAB) accredited BME degree in Vancouver.

Biomedical Engineering is a branch of applied science that fuses engineering and life sciences to address fundamental problems where human biology and physical design principles intersect. Using modeling and design from the macro- to the nano-scale, it will give the next generation of biomedical engineers the critical thinking and practical skills needed for scientific discoveries and inventions that promote health. The scope of Biomedical Engineering is broad. The program is comprehensive and includes four streams: (1) Cellular Bioengineering; (2) Biomedical Informatics; (3) Biomedical Systems and Signals; and (4) Biomechanics and Biomaterials. As a result, our graduates will be in demand in a variety of diverse contexts and environments including government agencies, medical research facilities, manufacturing and health services industries.

Over the last few decades, BME has evolved into a major field within engineering, and most large Universities provide training in the discipline. This is often as an option or sub-specialty within Chemical, Electrical or Mechanical Engineering Departments, and sometimes through stand-alone Biomedical Engineering Departments. Students enrolled in a BME option or sub-specialty, are not accredited as Biomedical Engineers by the Canadian Engineering Accreditation Board (CEAB). UBC’s Biomedical Engineering options (within Mechanical and Electrical & Computer Engineering) are examples. Furthermore, these options and UBC’s B.A.Sc. in Chemical and Biological Engineering are neither sufficiently broad to supply the biomedical technology sector, nor do they provide comprehensive preparation needed for development, commercialization and research careers. The proposed program was designed according to CEAB requirements and is expected to be accredited as a BME program by CEAB. Our graduates will then be eligible for professional engineer status as biomedical engineers.

Students pursuing other engineering programs currently at UBC all enter a common first year and apply to an engineering specialty for their second year. BME students will be admitted directly into the first year of the BME program and participate in their own common first year, somewhat different (but still quite similar) from the common year for all other disciplines. BME students need first year exposure to cell, tissue, organ and human biology and physiology, clinical perspectives, physiological modeling, and rapid prototyping that is not available in the common
engineering first year, nor are they covered in sufficient depth in existing Science courses. The new BMEG 101, 102, and 150 courses are specifically designed for the unique needs of BME students and will provide them with the specific backgrounds and perspectives they need to be successful in their more advanced courses.

Assuming AVED approval, students in our pilot cohort will begin their program taking an enhanced version of BMEG 101 and 102 in the summer of 2017. These students will also have taken APSC 101, PHYS 159 and ENGL 112 in the standard first year time table. For this pilot only, will make special arrangements for the students to take BMEG 150 as well as the second chemistry course.

Most courses and concepts in the common engineering first year are also in the BME program. This will allow students who enroll in BME in their first year and subsequently choose a different engineering discipline to transfer to another engineering discipline with relatively little extra work to catch-up.

2. Program Rationale

2.1. Introduction

Over the past year, with support from both Deans’ offices, members of the Faculties of Applied Science and Medicine have formed a Biomedical Engineering Program Advisory Committee comprising faculty from multiple areas of APSC and Medicine, including Chemical and Biological Engineering, Electrical and Computer Engineering, Mechanical Engineering, and Materials Engineering along with the Departments of Biochemistry, Cellular & Physiological Sciences, Pathology and Laboratory Medicine. The purpose of the committee was to determine if there was a market need for an undergraduate program in BME, and if so, to design a program that would address current and future market needs. The committee also consulted with the Departments of Chemistry, Microbiology & Immunology, Mathematics and Statistics within the Faculty of Science, and with the Faculty of Pharmaceutical Sciences. The following program proposal is the result of inter-disciplinary and collaborative planning on the part of this committee. The committee composition is available in the Appendices.

2.2. Market Analysis

2.2.1. Market Research Approach

In order to establish the viability of the proposed program, the following activities were undertaken:

1. Market research & concept development conducted through:
   a. Multiple meetings of the inter-disciplinary Biomedical Program Advisory Committee.
   b. Review of relevant recent labour market and industry reports. See Appendices
   c. Desktop research of comparable programs in Canada and the United States of America

2. Validation by external (industry) sector experts
   We consulted with and received feedback from representatives of many, including some of the largest, Biomedical Companies in the region. These include:
a. Scott Phillips, President
   Starfish Medical – Medical devices development
b. Allan Noordvyk, Executive Director of Research; Evgueni Loukipoudis, Chief
   Technical Officer, Imaging & Workflow Solutions; Todd J. Johnson, Executive
   Director of Radiology Product Management; Hui-Siong Ng, Director of
   Engineering for Radiology
   McKesson – Healthcare services company
c. Steven Woodside, Senior director Cell separation and engineering
   Stemcell – develops specialty cell culture media, cell separation products
   and ancillary reagents for life science research
d. Adam Lorant,
   VP, PHEMI, Big Data Solutions
   Partner, Magellan Angel Partners in high tech start-ups
e. Gyasi Bourne, VP (Engineering)
   VP LightIntegra – develops a diagnostic test for microparticles in blood
f. Laurent Angibaud, Director of Engineering
   Exactech – joint reconstruction solutions
g. Reza Yazdi, Senior Director of Research & Development
   Verathon – airway management and bladder volume measurement
   technology
h. Geof Auchinleck, CEO
   Claris Healthcare – software for caregivers and organizations
i. Alexi Marko, CEO and Director
   Neovasc – specialty cardiovascular medical devices
j. Geoff Houlton, President, CEO and Director
   Heartforce Medical – develops a seisomocardiograph
k. Andre Marziali, President, Founder and CSO
   Boreal Genomics – blood based detection and monitoring of tumor DNA
l. Josh Usher, Founder and Senior Engineer
   MistyWest – Engineering design consultancy

2.2.2. Market Insights
A review of labour market and industry reports (see Appendices) produced insights and data,
including the following, which support the large and growing need for Biomedical engineers in
BC, Canada and the world:
- The life sciences sector contributes significantly to B.C.’s economy
  - The sector in BC employs 180,000 and adds $14.4 billion to GDP (12% of GDP)
  - Innovation requires scientists who can develop innovation and recognize
    commercial potential
  - Access to talent is one of 4 top challenges to growing the sector in BC
- The top 20 Life Sciences companies in BC employed 195 research staff in 2015
- Health and Life Sciences is a key focus area in the BC Jobs Plan
• BCKDF\(^3\) has invested in nearly 300 health and biotechnology related infrastructure projects ($215 million), which illustrates provincial focus and growth potential
• BC Genomic researchers are ranked #1 in Canada for the impact of their work
• Genome BC has funded 140 projects and technology platforms ($368 million), attesting to the growth potential in the field
• In the United States, the number of biomedical engineering jobs is expected to grow twice as fast as the average rate of job growth for all industries
• In Alberta, half of the 130 bioindustry companies expect significant growth in the next few years. An additional 1,500 new positions are expected to be added to the 4,500 workers already directly employed in this sector
• Driving forces behind growth in the BME industry include an aging population, advances in biomedical technology, demand for personalized medicine, the mapping of the human genome, and increased complexity of medical care
• The projected growth rate for BME careers in California alone between 2014 and 2024 is more than 5000
• The US Department of Labour Statistics anticipates a 27% increase in BME jobs by 2022

The curriculum was well-received by our industry advisors. Some key insights from industry advisors include:
• There is demand in the Vancouver area for BME engineers – there is a long term skills shortage
• Ensure that the key knowledge and skills that make an excellent engineer are not compromised – employers are looking for engineers first and foremost: Engineers with experience and knowledge and skills specifically related to BME will be highly valued
• Industry wants biomedical engineers who
  o are great problem solvers
  o can write code
  o are competent at technical problems
  o are willing to learn
  o understand how data is structured – can extract information from large unstructured data sets
  o can communicate and collaborate effectively with a variety of stakeholders including doctors
  o understand workflow processes
  o understand regulatory and work processes within hospitals
  o have wet-lab skills and a working knowledge of microbiology processes, and
  o are competent and comfortable across the spectrum of engineering sciences related to BME (i.e. electrical, mechanical, biological, computer)

\(^3\) British Columbia Knowledge Development Fund is the government’s primary capital investment in support of research infrastructure in B.C. The BCKDF provides funding for public post-secondary institutions, research hospitals and affiliated non-profit agencies.
• BME space will change rapidly, particularly in areas such as genomics, and there will be an increasing need for flexible engineers who can manage large amounts of bio/health data and match it with machine learning
• Precision Medicine will be the next wave in medicine
• Demand for BME in the Vancouver area is growing by about 10% per year and currently has about 1000 engineers in the field
• Growing areas include Informatics and Machine Learning, Digital Imaging, Disease Detection and Health Monitoring Wearables
• Work terms are incredibly valuable to potential employers and very often work terms lead to permanent full time jobs on graduation
• Include experience in the regulatory environment specific to BME
• Consider the delivery schedule in terms of flexible learning options for those in remote areas or who have challenges getting release from work
• Capstone project and design experience is critical to student understanding
• Include content on innovation management and managing change
• Graduate pathways tend to be 1:1:1 ratio for Research:Medical-School:Industry

The BME program aligns with the feedback of industry and the market. Specifically, the streams were included as a direct result of industry recommendations. The courses (core and elective) were determined based on market and industry insights. We will ensure students develop robust core engineering skills, programming and data management skills, and biochemical wet laboratory skills. Our experiential learning work placement experience is designed and timed to align with the need of industry to have students in who have had specific experiences prior to the work placement and can stay in the position for extended periods of time.

2.2.3. Potential Sectors of Employment for Graduates
Undergraduate BME students take several different pathways upon graduation. These primarily include Medical School, Research, graduate/advanced/professional degrees, industry and entrepreneurial activities. For those that go on to employment, biomedical engineers work in hospitals, education and medical institutions, industrial and government research facilities, government and regulatory agencies, and manufacturing. They design, develop and evaluate biological and health systems in medical facilities or research laboratories. This translates into careers working with artificial organs, prostheses, instrumentation, medical information systems and healthcare management. They analyze problems within the medical environment and coordinate with other professionals to design solutions that improve patient care, quality and increase caregiver efficacy.

In the Vancouver area alone, there are dozens of biomedical companies, many of which are ranked in the top 100 Technology Companies in the province. Examples are included in the Appendices.

2.3. Program Description and Specifications
This program fuses engineering and life sciences to address fundamental problems where human biology and physical design principles intersect. Using modeling and design from the macro- to the nano-scale, it will give the next generation of bioengineers the critical thinking and practical skills needed for scientific discoveries and inventions that promote health.
The 4-year full time, 153 credit Vancouver program, offered jointly by the faculties of Medicine and Applied Science, will enroll 100 top international and domestic students annually. The curriculum is grounded in collaborative community projects and a reciprocal and experiential learning environment created between students and stakeholders.

2.3.1. Mission
The program will contribute to improving the health and lives of people around the world and contribute to the growing technology sector in BC, by training the next generation of engineers in an accredited biomedical engineering program.

2.3.2. Goals of the Proposed Program
The program will

- Develop uniquely qualified, solution-driven biomedical engineers with critical thinking and practical skills needed to
  - Support innovation through research, technology transfer and creation of spin-off companies, translating medical research into products and services, improving healthcare solutions in major areas of human disease,
  - Make Canada/BC a leader in the Global knowledge economy, and
  - Fill current and future job gaps;
- Offer students a project-based curriculum that explores cutting edge concepts, which will prepare them well for
  - Graduate, research and professional studies,
  - Medical school,
  - Industry employment, and
  - Entrepreneurial opportunities; and
- Help UBC emerge as a leading institution in Biomedical Engineering (BME).

2.3.3 Program Learning Outcomes
Graduates of the Biomedical Engineering program will be able to:

- Formulate, model and understand – through analysis and experimental work – biomedical engineering problems through the application of insights and techniques from the physical sciences, biology, engineering and mathematics, and
- Design, in collaboration with medical doctors and life scientists, appropriate technologies, performance metrics, and validation methods that address problems at the interface between engineering and medicine and improve human health.

More specifically, graduates of the program will:

- Make decisions based on an understanding of complex life sciences systems from a systems perspective,
- Identify and pursue opportunities for technology integration in life sciences research and development,
- Exhibit the highest standards of ethics, safety, social awareness and professionalism,
- Be equipped to work in multidisciplinary research and engineering teams, able to grasp and
master information and concepts from ancillary disciplines quickly,

- Communicate and work effectively with professionals and researchers including physicians and biological scientists, and
- Write business plans and have knowledge regarding translation of laboratory innovations to regulated markets.

### 2.3.4. Program Degree Requirements

After a common first and second year, BME students select one of four streams for the remainder of their program. Streams allow students to focus on particular areas of Biomedical Engineering. The stream does not appear as a major or a specialization on the students’ parchment or on their transcript.

The program requires the completion of 153 credits including the following mandatory courses:

- APSC 100, 160;
- BIOC 202;
- CHBE 251, 351;
- CHEM 121, 123, 233, 235;
- CPEN 221;
- ELEC 371;
- ENGL 112;
- MATH 100, 101, 152, (226 or 253), 256; 264;
- PHYS 157, 158, 170;
- STAT 251, 300; and
- BMEG 101, 102, 150, 201, 210, 220, 230, 250, 257, 310, 350, 357, 430, 450, 456,

as well as 6 credits in Complementary Studies*

Plus one of the streams listed below:

#### Cellular Bioengineering Stream

Students must complete the following courses:

- BMEG 410, CHBE 381, BIOC 302 and CHEM 211

And 13 credits of technical electives to be chosen from a course list available on the program website and in consultation with an undergraduate advisor.

#### Biomedical Informatics Stream

Students must complete the following courses:

- CPSC 221, 340, BIOC 302, and either MATH 220 (3 credits) or CPSC 121 (4 credits)

And 13-14 credits of technical electives to be chosen from a course list available on the program website and in consultation with an undergraduate advisor.

#### Biomedical Systems and Signals Stream

Students must complete the following courses:

- BMEG 320 and ELEC 221

And 20 credits of technical electives to be chosen from a course list available on the program website and in consultation with an undergraduate advisor.

#### Biomechanics and Biomaterials Stream

Students must complete the following courses:

- APSC 278; MECH 260; BMEG 330

And 18 credits of technical electives to be chosen from a course list available on the program website and in
consultation with an undergraduate advisor.

* See Complementary Studies Courses. Students intending to apply to medical school will require an additional ENGL course, which can be taken as a complementary studies course.

### 2.3.5. Admission Requirements

Admission requirements for the UBCV Biomedical Engineering Program will be the same as the admission requirements for all other direct-entry engineering programs at the UBC Vancouver campus, with one additional requirement. Beginning with the first non-pilot cohort (September 2017), Biology 12 (or equivalent) will be required. For reference, the existing calendar text is available at the following link: [http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,272,28](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,272,28).

Resources have been committed by APSC and the FOM to commence the program with a 25 student pilot cohort. A select group of 25 students who finished their common engineering first year in April 2017 will be selected into the pilot and will have access to the summer courses that form part of the new program. Between mid-March and May 15, students finishing the first year of their common engineering courses submit a Preference Form in which they indicate and prioritize the engineering programs they would like to study for the remainder of their degree. Details of this process can be found on the engineering website [http://students.engineering.ubc.ca/enrolment/placement/?login](http://students.engineering.ubc.ca/enrolment/placement/?login). We will add BME as an option for students to choose in March 2017. It will carry the caveat that the program will only be offered if and when it receives AVED approval. We will select students to the pilot program according to the same processes outlined for the other programs. Students are not limited in the number of placements to which they can apply. Therefore, applying to BME is not a disadvantage to students if the program is not approved by AVED prior to September 2017.

Pilot students will then take BMEG 101 and 102 in the summer of 2017. These students will also have taken APSC 101, PHYS 159 and ENGL 112 in the standard engineering first year time table. For this pilot only, we will make special arrangements for the students to take BMEG 150 as well as the second chemistry course. Pilot students will enter their second year of the BME specific pilot program in September 2017. September 2017 will also see the enrolment of the first full 100 student BME cohort into first year engineering.

### 2.3.6. Program Management and Assessment

Until the formation of the School of Biomedical Engineering is completed, this document proposes that the degree program be situated within the Faculty of Applied Science and managed by APSC in the same manner that other interdisciplinary undergraduate engineering programs (e.g., Integrated Engineering and Environmental Engineering) are managed. A proposal for a new School of Biomedical Engineering, jointly administered by the Faculties of Medicine and Applied Science is being developed in parallel to the proposal for the BME program. The intent
is to offer the BASc in biomedical engineering (and other related graduate programs) within the proposed School of Biomedical Engineering once, and if, the proposal for the School is approved and the academic unit is created.

In brief, the School of Biomedical Engineering at UBC would be jointly and equally governed, administered and supported by the Faculties of Medicine and Applied Science. The director of the School will report to both the Dean of Medicine and the Dean of Applied Science. All issues that require the Dean’s approval will require the approval of both Deans. A governance committee comprised of both APSC and FoM deans, the director, associate dean research and associate dean education from both faculties will meet biannually to review progress of the school and set strategy and direction.

The Director will have an Executive Council drawn from faculty within the School. The Council will meet regularly to provide the Director with advice on key issues, although final decisions will remain with the Director.

The School will have an Advisory Board that will meet twice a year and provide the Director with advice. The Board will be composed of interested members of the broader community.

Undergraduate student matters and affairs including admissions, promotion through the year, calendar policy, accreditation, and appeals will be administered by the Faculty of Applied Science.

The proposed program conforms to the accreditation standards of the Canadian Engineering Accreditation Board (CEAB). As such, an accreditation site visit will occur during the fall of the year during which the first cohort is scheduled to graduate and at least every 6 years thereafter.

2.4. Contribution to UBC Mandate and Strategic Plan

2.4.1. Student Learning

- The University provides the opportunity for transformative student learning through outstanding teaching and research, enriched educational experiences, and rewarding campus life.

The BME program will offer an exceptional learning environment for students, will attract students from around the world to study in Vancouver’s diverse environment, and will be in demand across the globe. The program’s comprehensive curriculum draws upon the combined expertise of faculty in Applied Sciences and in the Faculty of Medicine. The program will synthesize theory and practice through a challenging learning experience that will equip students with the knowledge, attitudes, skills and experience needed to excel in one of the world’s most important and fast-growing industries. Strong stakeholder support and existing relationships between UBC APSC and local companies promises students both a rich educational experience and employment opportunities after graduation.

2.4.2. Innovation Excellence

- The University creates and advances knowledge and understanding, and improves the quality of life through the discovery, dissemination, and application of research within and across
disciplines.

As a leading research and educational facility, UBC is a world leader, and should be the Canadian leader in the area of biomedical engineering, as we invest time and resources to create, sustain and grow for the future. By expanding UBC’s current scholarship in the areas of this program, UBC will not only be a leader in the exchange of knowledge in these areas; it will also, by contributing to the involved industries, be a central part of the means by which people and knowledge are mobilized. The program and the School of Biomedical Engineering will expand opportunities for research and research funding, and increase cross-cutting and inter-disciplinary work.

Furthermore, the UBC strategic plan includes “Public Interest” as the theme for one of six core values: “The University embodies the highest standards of service and stewardship of resources and works within the wider community to enhance societal good.” The BME program will develop graduates uniquely prepared to support innovation and improve healthcare solutions in major areas of human health and disease.

2.4.3. Community Engagement

- The University serves and engages society to enhance economic, social, and cultural well-being.

Engaging with local companies with regard to the needs of their sector is one of the key components of the program. With a curriculum grounded in collaborative community projects, a reciprocal and experiential learning environment will be created between students and local stakeholders. The program will contribute to BC’s ability to capitalize on and expand the growing biotech sector that is already in the lower mainland.

2.4.4. International Engagement

- The University creates rich opportunities for international engagement for students, faculty, staff, and alumni, and collaborates and communicates globally.

When we speak of globalization today, it is a synthesis of exploration, learning, and the global exchange of resources and knowledge – not unlike the university itself. The program will graduate students who will be in demand across the globe, and in industries based in Canada. It will graduate the trained BME professionals needed to ensure the self-sufficiency of Canada’s biomedical technology sector, and the global influence of Canada itself in the field. Strong industries, backed by highly qualified professionals, are key to securing Canada’s global presence – to improving and sustaining Canada’s innovation and economy, and strengthening Canada’s contribution to the global market. By offering the program, UBC will therefore become an invaluable player in both national and international development.

Additionally, students from all over the world will come to UBC for this program. Once enrolled, students will have opportunities to work and study abroad in the Coordinated International Experience Exchange program.

2.4.5. Sustainability

- The University explores and exemplifies all aspects of economic, environmental, and social sustainability.
The program will play a role with the rest of the UBC community to meet society’s needs without compromising those of future generations. Sustainability will be an ongoing thread in the BMEG courses and workplace learning experiences. The program will be accountable and transparent in the use of available resources.

2.5. Relationship to Established Programs

2.5.1. The University of British Columbia

The Faculty of Applied Science currently runs BME options from within the departments of Electrical & Computer Engineering, and Mechanical Engineering. It also offers a Bachelor program in Chemical and Biological Engineering. These are successful and popular programs. The BME Option in Electrical and Computer Engineering currently receives between 50 and 70 applicants for its 24 seats annually. The number of graduate students enrolled at UBC in Biomedical Engineering has also been rising steadily at both the Masters and PhD levels since 2006. In 2015 there were 65 UBC BME graduate students. An undergraduate degree in Biomedical Engineering would better prepare our students for our graduate programs and for those at other universities domestically and abroad.

Jointly, with the British Columbia Institute of Technology (BCIT), UBC also offers an honours 5-year, 132-credit Bachelor of Science program specializing in Biotechnology. Students study at both schools (years 2 and 3 are at BCIT). The joint program is not an engineering program, does not include design, (which is an important feature of the new BME program at UBC), and is not medically focused. The joint program focuses more broadly on biotechnology, including plant biotechnologies and a heavy emphasis on microbiology. The joint program is not addressing the same labour or research markets nor is it likely to be attracting the same pool of students.

We are not proposing to eliminate or change the joint UBC-BCIT program, the B.A.Sc. program in chemical and biological engineering or the BME Options programs. We are not in competition with these programs and they contribute well to their sectors. The programs’ foci and graduate destinations are different from those of the BME program. Additionally, maintaining these programs will provide flexibility for students, particularly those who do not gain admittance to the BME program. Existing BME options, however, are insufficiently broad to adequately supply the biomedical technology sector, which represents 55% of the Canadian biotechnology industry. The current options also do not provide the comprehensive preparation required for development, commercialization and research careers.

2.5.2. Other British Columbia and Canadian universities

The proposed UBC program is expected to be accredited with the Canadian Engineering Accreditation Board (CEAB) as a Biomedical Engineering program. There are currently no undergraduate programs in B.C. accredited as BME with CEAB. The University of Victoria, however, anticipates accreditation for its BME program in the Fall of 2016. The following are currently not accredited:

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4 At the time of our submission to UBC Senate for approval, the program had not yet been accredited.
**Simon Fraser University** offers a BME option within its electrical and its mechanical engineering programs. There are no opportunities for study specializing in Cellular Bioengineering or in Biomedical Informatics, which are both growing and dynamic fields in the biomedical sector. Their program was developed with the school of Kinesiology (not Medicine) and mostly consists of courses that are shared by students in other engineering programs. After 2 common years of engineering, BME students at SFU are streamed in 3rd year and then begin their first BME course (after already completing a work term). The UBC BME program introduces BME specific courses in first year. The SFU program only has 3 work terms (not 4), its capstone project is a group endeavor and it only allows 3 technical electives. A thesis is required at SFU.

**The University of Victoria** currently offers a BME option within the Computer, Electrical and Software Engineering programs. It is not currently accredited as a BME degree, however accreditation is anticipated this fall\(^5\). Students specialize in either Electrical or Mechanical BME. Foci on subspecialties of BME such as biomaterials, instrumentation, biophotonics, or imaging are achieved by elective and work placements, and not by a specific program stream of study. There are no opportunities for stream study specializing in Cellular Bioengineering, Biomedical Systems and Signals, Biomechanics and Biomaterials or in Bioinformatics, which are growing and dynamic fields in the biomedical sector. There is more emphasis on general electrical and mechanical engineering principles and less opportunity for BME specific applications. A thesis is required.

There are only 6 Canadian post-secondary institutions currently offering a CEAB accredited undergraduate degree in biomedical engineering:

<table>
<thead>
<tr>
<th>University</th>
<th>Department</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryerson University</td>
<td>Department of Electrical and Computer Engineering</td>
<td>Bachelor of Engineering in Biomedical Engineering</td>
</tr>
<tr>
<td>University of Ottawa</td>
<td>Biomedical Mechanical Engineering</td>
<td>B.A.Sc in Biomedical Mechanical Engineering</td>
</tr>
<tr>
<td>University of Guelph</td>
<td>Biomedical Engineering</td>
<td>B.Eng. in Biomedical Engineering</td>
</tr>
<tr>
<td>Carlton University</td>
<td>Mechanical and Aerospace Engineering</td>
<td>B.Eng in Biomedical &amp; Mechanical Engineering or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B.Eng in Biomedical and Mechanical Engineering</td>
</tr>
<tr>
<td>McMaster University</td>
<td>Electrical and Computer Engineering</td>
<td>B.Eng. in Electrical and Biomedical Engineering</td>
</tr>
<tr>
<td>Ecole Polytechnique (University de Montreal)</td>
<td></td>
<td>Genie biomedical</td>
</tr>
</tbody>
</table>

The following Canadian engineering programs offer other engineering degrees with options or specializations in BME and are not accredited as BME degrees by CEAB:

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\(^5\) At the time of our submission to UBC Senate for approval of our BMEG program, the UVIC program had not yet been accredited.
<table>
<thead>
<tr>
<th>University</th>
<th>Department</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Calgary</td>
<td>Centre for Bioengineering Research and Education</td>
<td>Specialization in Biomedical Engineering within one of the regular Bachelor of Science in Engineering degrees</td>
</tr>
<tr>
<td>University of Toronto</td>
<td>Division of Engineering Science</td>
<td>Biomedical Systems Engineering Major in Engineering Science</td>
</tr>
<tr>
<td>University of Manitoba</td>
<td>Biosystems Engineering</td>
<td>Bachelor of Science in Engineering (Biosystems)</td>
</tr>
<tr>
<td>University of New Brunswick</td>
<td>Chemical Engineering</td>
<td>BScE (Biomedical option)</td>
</tr>
<tr>
<td>University of Ottawa</td>
<td>Biomedical Mechanical Engineering</td>
<td>B.A.Sc in Biomedical Mechanical Engineering</td>
</tr>
<tr>
<td>University of Ottawa</td>
<td>Chemical Engineering</td>
<td>B.A.Sc in Chemical Engineering; BME option</td>
</tr>
<tr>
<td>McMaster University</td>
<td>Electrical and Computer Engineering</td>
<td>B.Eng.Biosci in Chemical Engineering and Bioengineering</td>
</tr>
<tr>
<td>University of Western Ontario</td>
<td>Electrical and Computer Engineering</td>
<td>B.E.Sc. in Electrical Engineering with Biomedical Signals and Systems Option</td>
</tr>
<tr>
<td>University of Western Ontario</td>
<td>Electrical and Computer Engineering</td>
<td>B.E.Sc. in Electrical Engineering concurrent with B.Sc. in Medical Biophysics</td>
</tr>
<tr>
<td>University of Western Ontario</td>
<td>Electrical and Computer Engineering</td>
<td>B.E.Sc. in Electrical Engineering Software Engineering - Health Informatics Option</td>
</tr>
<tr>
<td>McGill University</td>
<td>Biomedical Engineering</td>
<td>B.Eng. with a Minor in Biomedical Engineering</td>
</tr>
<tr>
<td>University of Waterloo</td>
<td>Biomedical Engineering</td>
<td>B.A.Sc. Biomedical Engineering</td>
</tr>
</tbody>
</table>

In addition to UBC graduate programs, graduates of the UBC BME undergraduate program will be well positioned for application to Canadian graduate programs in Biomedical Engineering including the following:

<table>
<thead>
<tr>
<th>University</th>
<th>Department</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Toronto</td>
<td>Institute of Biomaterials and Biomedical Engineering</td>
<td>Professional M.Eng. in BME (medical devices); Professional M.H.Sc. in Clinical Engineering; Research M.A.Sc in BME; Research Ph.D. in BME; Graduate Certificate in BME</td>
</tr>
<tr>
<td>University</td>
<td>Department</td>
<td>Program</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>University of Calgary</td>
<td>M.Eng., M.Sc., or Ph.D in Biomedical Engineering</td>
<td></td>
</tr>
<tr>
<td>University of Alberta</td>
<td>Biomedical Engineering</td>
<td>M.Sc. and Ph.D.</td>
</tr>
<tr>
<td>University of Manitoba</td>
<td>School of Biomedical Engineering</td>
<td>M.Sc. and Ph.D.</td>
</tr>
<tr>
<td>McMaster University</td>
<td>School of Biomedical Engineering</td>
<td>M.A.Sc. and Ph.D. in Biomedical Engineering</td>
</tr>
<tr>
<td>Ryerson University</td>
<td>M.Eng., M.A.Sc. and Ph.D. in BME</td>
<td></td>
</tr>
<tr>
<td>University of New Brunswick</td>
<td>Institute of Biomedical Engineering</td>
<td>M.Sc. and Ph.D.</td>
</tr>
<tr>
<td>Dalhousie University</td>
<td>School of Biomedical Engineering</td>
<td>M.A.Sc and Ph.D.</td>
</tr>
<tr>
<td>McGill University</td>
<td>Ottawa-Carlton Institute for Biomedical Engineering</td>
<td>M.A.Sc. in Biomedical Engineering</td>
</tr>
<tr>
<td>Ottawa-Carlton Universities</td>
<td>University</td>
<td></td>
</tr>
<tr>
<td>University of Western Ontario</td>
<td>Electrical and Computer Engineering</td>
<td>M.E.Sc in Biomedical Systems and Ph.D.</td>
</tr>
</tbody>
</table>

International post-secondary institutions of note offering similar undergraduate degrees include:

<table>
<thead>
<tr>
<th>University</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johns Hopkins</td>
<td>B.S. in Biomedical Engineering with 5 focus areas including Cell/Tissue Engineering; Computational Biology and Sensors, Micro/nano systems and instrumentation</td>
</tr>
<tr>
<td>Georgia Tech</td>
<td>B.S. in Biomedical Engineering</td>
</tr>
</tbody>
</table>

2.5.3. Level of support and recognition from other post-secondary institutions

UBC is recognized as one of the world’s leading academic centers for both Medicine and Engineering. The BME program is designed to meet the accreditation standards of the Canadian Engineering Accreditation Board (CEAB) and admission pre-requisites for Canadian Medical Schools.

2.6. Target Students

Engineering at UBC currently receives more than 5 qualified applications for every seat in the program. BME students will be drawn from the same strong candidate pool. Currently, the BME Option within Electrical and Computer Engineering alone receives between 50 and 70 applicants.
for its 24 seats. Of note, women have tended to apply to Biomedical Engineering more than to other fields of engineering. Currently, UBC engineering programs receive only about 32% of their applications from women. The BME degree therefore opens up a broader student market base for UBC. Traditionally, for our first year program approximately 89% of our students register directly out of high school, and <2% transfer to UBC engineering from other degree programs at UBC. We admit a further ~200 students into our second year (directly into majors) from our eight engineering transfer program partners across the province.

2.6.1. Enrolment Predictions and Capacity
The first year of the program will enroll a reduced pilot cohort of 25 students. Subsequent years’ enrollment will be capped at 100 new students per year. Due to high application pressure, we anticipate no difficulty in reaching these targets.

2.6.2. Tuition Rationale
Tuition for the BME program will be the same as for other UBC engineering programs.

2.6.3. Scholarships
Students in the BME program will have access to the same scholarship opportunities as other UBC engineering students.

2.6.4. Opportunities for Further Study
The BME program will prepare students for advanced research degrees in engineering (i.e. Ph.D., M.A.Sc.), for graduate professional programs such as the Masters of Health Leadership and Policy or the Master of Engineering Leadership as well as for entry into Medical School. Students intending to apply to medical school will need to take an additional English course as one of their complementary studies courses. Although 6 credits in BIOL are strongly recommended for application to medical school, the UBC Faculty of Medicine has confirmed that our curriculum, especially BMEG 150, 250 and 350, will be considered as satisfying the recommendation.

3. Program Resources

3.1. Program Funding and Budget
This program will require additional funding and will bring in additional revenue. A financial proposal is has been prepared by the Applied Science and the Faculty of Medicine business officers for the BME program and for the School of Biomedical Engineering. A budget impact form has been submitted.

3.2. Space Requirements
The addition of an extra 100 students each year will require new additional educational spaces, and the need for space increases over the first four years as the program reaches full capacity. A proposal for a new Biological and Environmental Engineering Building has received for Executive Review and Approval (Exec 1) and is scheduled for Board 1 review for summer 2017. This facility will meet our growing laboratory, classroom and administrative needs. In the short term, until that space is available, we will be challenged to accommodate the students in existing spaces, with a particular challenge for laboratory space. However, we will have to work within the options that we find available including spaces in APSC, Life Sciences Institute, and the
Biomedical Research Centre. In addition, research space for Faculty will be available at the UBC Teaching Hospitals.

3.3. Library Resources
The program and its new courses were reviewed and approved by the library. Courses requiring new resources will be funded by the APSC Dean’s Office.

3.4. Qualified Faculty
UBC Engineering has faculty experienced, qualified and recognized as leaders in their fields. This includes the numerous faculty currently engaged in the core engineering courses that current students and BME students will take, as well as faculty with specific expertise related to biomedical engineering. A non-exhaustive list of Faculty with expertise in BME is found in the Appendices. As the program rolls out, there will be a need for additional faculty. These resource needs are described separately in the proposal for the joint Faculty of Applied Science and Faculty of Medicine School of Biomedical Engineering.
4. Calendar Statement - Program

UBC Curriculum Proposal
Form Category: 1

Faculty: Applied Science
Department: Engineering
Faculty of Approval Date: Oct 27, 2016
Effective Session (W or S): S
Effective Academic Year: 2017

Date: 
Contact Person: Elizabeth Croft
Phone: (604) 822-6614
Email: ecroft@mech.ubc.ca

URL: 
[please create a calendar page]

Proposed Calendar Entry:

Bachelor of Applied Science (B.A.Sc.) in BIOMEDICAL ENGINEERING

Program Overview

The Faculty of Applied Science offers a program leading to the Bachelor of Applied Science in Biomedical Engineering. Biomedical Engineering (BME) addresses fundamental problems where human biology and physical design principles intersect. The program gives biomedical engineers the skills required to make scientific discoveries and inventions that promote health.

Typically, UBC engineering programs begin with a common first year after which students apply for registration in second year in a specific engineering discipline. The BME program allows students to take introductory material core to the program in first year through registration in a modified first year timetable. Students wishing to study in the BME program apply for registration in a modified first year timetable when they apply to UBC’s first year Engineering Program. Selection for the modified timetable is limited and competitive.

Transfer into second year BME for students who have completed the standard first year in the UBC engineering program (or a comparable program at another university or college) is limited to students

Present Calendar Entry:

N/A

Type of Action:
Create new undergraduate program in the Faculty of Applied Science

Rationale for Proposed Change:
There is current and growing market demand for biomedical engineers in the lower mainland, BC, Canada and the world. UBC is a leader in Engineering and in Medicine and is well positioned to prepare graduates in the field. UBC’s current Biomedical Engineering option in Electrical and Computer Engineering and the B.A.Sc. in Chemical and Biological Engineering are insufficiently broad to supply the biomedical technology sector nor do they provide comprehensive preparation needed for development, commercialization and research careers.

Initially, the new program will be housed within The Faculty of Applied Science. However, the intent is for the program to be housed in a new School of Biomedical Engineering: a proposal for which is being developed in parallel.
with high academic standing, and requires approval of the BME program advisor. Students who transfer into BME will have to complete any missing course requirements. Students wishing to transfer into BME at second year should consult the program website and their academic advisor.

Students completing their first year of the BME modified first year timetable will be eligible to transfer into other Engineering programs at UBC for their second year.

The program is designed with four streams of technical electives to allow students to focus on particular areas of Biomedical Engineering: 
*Cellular Bioengineering; Biomedical Informatics; Biomedical Systems and Signals; and Biomechanics and Biomaterials.* After their second year, BME students indicate their prioritized stream preferences. Prospective students should be aware that a maximum enrolment limit may apply to each stream. If student preferences for a stream exceed capacity for that stream, the program Director will select students for the stream based on academic standing and demonstrated interest and ability in that specific stream.

Consult the program website for technical elective selection for each stream.

The program is designed to align with admissions criteria for medical school. Students intending to apply to medical school after their biomedical engineering program must take a first year English course as a complementary study. Other courses within the program are considered equivalent for the purposes of the Biology content recommended by the UBC Faculty of Medicine.

**Program Requirements**

**First Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>APSC 100</td>
<td>3</td>
</tr>
<tr>
<td>APSC 160</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 150</td>
<td>4</td>
</tr>
<tr>
<td>Course</td>
<td>Credits</td>
</tr>
<tr>
<td>----------</td>
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</tr>
<tr>
<td>CHEM 121</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 123</td>
<td>4</td>
</tr>
<tr>
<td>MATH 100</td>
<td>3</td>
</tr>
<tr>
<td>MATH 101</td>
<td>3</td>
</tr>
<tr>
<td>MATH 152</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 157</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 158</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 170</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
</tr>
</tbody>
</table>

**First Summer**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENGL 112</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 101</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 102</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
</tr>
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**Second Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 253 or 226</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 201</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 210</td>
<td>2</td>
</tr>
<tr>
<td>BMEG 220</td>
<td>4</td>
</tr>
<tr>
<td>BMEG 230</td>
<td>4</td>
</tr>
<tr>
<td>BMEG 250</td>
<td>4</td>
</tr>
<tr>
<td>BMEG 257</td>
<td>4</td>
</tr>
<tr>
<td>CHBE 251</td>
<td>3</td>
</tr>
<tr>
<td>CPEN 221</td>
<td>4</td>
</tr>
<tr>
<td>MATH 256</td>
<td>3</td>
</tr>
<tr>
<td>MATH 264</td>
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**Third Year**

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>BIOC 202</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 310</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 350</td>
<td>4</td>
</tr>
<tr>
<td>BMEG 357</td>
<td>3</td>
</tr>
<tr>
<td>CHBE 351</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 235</td>
<td>1</td>
</tr>
</tbody>
</table>
ELEC 371 3  
STAT 251 3  
Complementary Studies Electives\(^1\) 3  
Stream-based Technical Electives 9  
Total Credits 38

### Fourth Year

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>STAT 300</td>
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<tr>
<td>BMEG 456</td>
<td>3</td>
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<tr>
<td>BMEG 450</td>
<td>6</td>
</tr>
<tr>
<td>BMEG 430</td>
<td>3</td>
</tr>
<tr>
<td>Complementary Studies Electives(^1)</td>
<td>3</td>
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<tr>
<td>Stream-based Technical Electives</td>
<td>18</td>
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<tr>
<td>Total Credits</td>
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### Stream Based Technical Electives

Students completing the Cellular Bioengineering Stream must complete the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 211</td>
<td>4</td>
</tr>
<tr>
<td>CHBE 381</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 410</td>
<td>4</td>
</tr>
<tr>
<td>BIOC 302</td>
<td>3</td>
</tr>
<tr>
<td>Additional technical electives(^2)</td>
<td>13</td>
</tr>
</tbody>
</table>

Students completing the Biomedical Informatics Stream must complete the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPSC 221</td>
<td>4</td>
</tr>
<tr>
<td>CPSC 340</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 302</td>
<td>3</td>
</tr>
<tr>
<td>Either MATH 220</td>
<td>3</td>
</tr>
<tr>
<td>Or CPSC 121</td>
<td>4</td>
</tr>
<tr>
<td>Additional technical electives(^2)</td>
<td>13 (if taking CPSC 121)</td>
</tr>
<tr>
<td></td>
<td>14 (if taking CPSC 121)</td>
</tr>
</tbody>
</table>
Students completing the Biomedical Systems and Signals Stream must complete the following:

- **BMEG 320** 3
- **ELEC 221** 4
- Additional technical electives\(^2\) 20

Students completing the Biomaterials Biomechanics Stream must complete the following:

- **APSC 278** 3
- **MECH 260** 3
- **BMEG 330** 3
- Additional technical electives\(^2\) 18

1. See [Complementary Studies Courses](#). Students planning to apply to Medical School should take a first year English course as their complementary studies elective. Students should confirm the specific pre-requisite courses for the Medical School(s) to which they will apply.

2. To be chosen from a course list available on the program website and in consultation with an undergraduate advisor.

### Cooperative Education Experiential Work Terms

Cooperative education experiential learning placements are an integral part of the Bachelor of Applied Science in Biomedical Engineering program. Students will typically complete four 4-month experiential learning placements coordinated through the Applied Science Co-op Program. Work terms can take place during the Winter or Summer terms. Students should refer to the program website for the current schedule. Students unable to complete one or more co-op terms should consult with a departmental advisor.

### Contact Information
Introduction

The Faculty offers programs of undergraduate study leading to the Bachelor of Applied Science in the following areas of engineering: Biomedical Engineering, Chemical Engineering, Chemical and Biological Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Engineering Physics, Geological Engineering, Integrated Engineering, Materials Engineering, Mechanical Engineering, and Mining Engineering. It also offers the Bachelor of Applied Science in Environmental Engineering as a joint program with the University of Northern British Columbia.

The Faculty of Applied Science admits suitably qualified applicants directly from secondary school into first-year engineering. These students will normally complete the Bachelor of Applied Science in four years of academic study, except in the case of the Engineering Physics program, which requires five years' study. Students may also enter the engineering program after spending one or more years in the Faculty of Science, either because they wish to avail themselves of a broader range of...
electives or because they do not meet the entrance requirements for admission directly from secondary school (see Admission from BC/Yukon Grade 12 (or equivalent)). Depending on the transfer credit in engineering received from first-year Science (see Admission from Science), such students may be able to complete an engineering degree with three further years of study, otherwise they will require four further years.

**Admission**

Application for admission to the Engineering program must be made through Enrolment Services no later than January 15. The applicant is responsible for ensuring that all supporting documents, including official transcripts, are submitted to Enrolment Services by the deadlines provided following the submission of an application, otherwise the application will not be considered.

**Admission from BC/Yukon Grade 12 (or equivalent)**

In addition to satisfying university admission requirements, applicants must have completed mathematics, physics, and chemistry at the BC Grade 12-level, or the equivalent. Students wishing to study in the Biomedical Engineering program must also have completed Grade 12 Biology or equivalent. Students will be selected on the basis of their standing in Grade 12 courses in mathematics, chemistry, physics, and English. Applicants from schools

**URL:**

http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,272,28

Application for admission to the Engineering program must be made through Enrolment Services no later than January 31. The applicant is responsible for ensuring that all supporting documents, including official transcripts, are submitted to Enrolment Services by the deadlines provided following the submission of an application, otherwise the application will not be considered.

**Admission from BC/Yukon Grade 12 (or equivalent)**

In addition to satisfying university admission requirements, applicants must have completed mathematics, physics, and chemistry at the BC Grade 12-level, or the equivalent. Students will be selected on the basis of their standing in Grade 12 courses in mathematics, chemistry, physics, and English. Applicants from schools
chemistry, physics, and English. Applicants from schools where either Physics 12 or Chemistry 12 is not available may petition to be excused this deficiency.

Admission from a Post-Secondary Institution

Applicants from another faculty at UBC or another post-secondary institution may be considered for admission to the engineering program of the Faculty of Applied Science. An overall average of at least 65%, including any failed courses, is required. The overall average is calculated in accordance with the general admission requirement for undergraduate applicants from a college or university.

Applicants must also have an average of at least 70% in all chemistry, mathematics, and physics courses which transfer to the first-year engineering program. Courses to be considered in this average of mathematics, chemistry, and physics courses are not limited to the last 30 credits only. Students wishing to study in the Biomedical Engineering program must also have completed Grade 12 Biology or equivalent. Where two courses, or one repeated course, have been taken which transfer to one of the courses of the first-year engineering program, only the grade of the latest course will be used in calculating this average.

Admission to the engineering program is competitive. Applicants who meet all of these criteria are not guaranteed admission.

Applicants with less than 24 transferable credits from a post-secondary institution are evaluated against both secondary and post-secondary admission criteria.

Applicants with more than 26 credits of transfer
credit in first-year engineering may be eligible for second-year engineering. Advice on transfer credit is available from the Dean's Office, Engineering Student Services. Deficiencies from first-year must be completed prior to graduation.

Students admitted to second year must complete a Second Year Program Preference Form by June 15.

Exemptions are given for courses in first-year Applied Science for the following courses normally taken in first-year Science at UBC:

Students wishing to study in the Biomedical Engineering program must also have completed Grade 12 Biology or equivalent and should be prepared to take additional course work in the summer prior to second year in order to transition into the program.

Admission from UBC Engineering Transfer Programs

Students who have completed first-year engineering at a college offering a UBC transfer program are eligible to be considered for admission to second-year engineering provided that they have obtained an overall grade point average of at least 2.8. Students wishing to study in the Biomedical Engineering program must also have completed Grade 12 Biology or equivalent and should be prepared to take additional course work in the summer prior to second year in order to transition into the program.

URL: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,272,30

Degree Requirements

A student will be granted a Bachelor of Applied Science only after obtaining credit for all courses listed in the program of study for a
Science only after obtaining credit for all courses listed in the program of study for a given engineering program. This requirement will normally be met by completing four Winter Sessions with full credit load (five Winter Sessions for the Engineering Physics Program, and nine academic terms for the Biomedical Engineering Program). With the approval of the Dean's Office, a student may be allowed to study on a part-time basis. Credit will be granted for courses completed during the Summer Session.

English Requirement

The Faculty of Applied Science recognizes that good communication skills in English are essential to the understanding of course material and to the successful practice of engineering. To qualify for the B.A.Sc., a student must complete ENGL 112 (or equivalent) and an approved technical communication course. Students admitted directly from secondary schools are required to take English in their first year if eligible to do so. To be eligible, students must have met the Language Proficiency Index Requirement for First-Year English. Once admitted to UBC, students will not normally be permitted to satisfy the English requirements at another institution. Students should take particular notice of the English requirements for advancement in the Faculty (see Advancement). Students in the Biomedical Engineering program who plan on applying to medical school should take an additional English course.

URL:
Curriculum and First Year

First Year

Students admitted into the Engineering program directly from secondary school will take a common first-year curriculum. Students identified as being eligible to take Biomedical Engineering Program content in first year will receive a modified first year timetable.

The typical transfer program is appropriate for most students transferring into the Faculty from the first year of a science program at UBC or another university or college. Applicants with more than 26 credits of engineering transfer credit may be eligible for second-year engineering. See Admission from a Post-Secondary Institution.

For information about the first year curriculum and transferring into the Biomedical Engineering Program, refer to the UBC calendar page for the Biomedical Engineering program.

Other students will need to contact Engineering Student Services for advice on their first-year program.

URL: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,272,233

Pre-Med Alternative Path

This alternative path is intended for students with an engineering background wishing to apply to medical schools. It provides access to courses required by many medical schools for students to
required by many medical schools for students to be considered for admission. Registration in this alternative path is very competitive and is limited.

Different medical schools have different course requirements. Students are strongly advised to verify the course requirements with prospective medical schools. It should also be noted that the course requirement is only one of the criteria used by medical schools to assess applications. It is the student's responsibility to be informed of the applicable criteria.

The Biomedical Engineering Program

The Biomedical Engineering Program is another Pre-Med path available to UBC engineering students. Students who wish to apply to medical school who are enrolled in the Biomedical Engineering Program should take one additional English course as one of their complementary studies electives. Other courses in the Biomedical Engineering program are accepted as meeting the UBC Faculty of Medicine recommendations. Students are advised to consult with other Medical programs if they plan on applying to other schools.

[Please include a hyperlink to http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,209,374,340 in the blue highlighted area to the left]

URL: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,272,0

Bachelor of Applied Science

Contents

Introduction
Academic Advising

Curriculum and First Year

Biomedical Engineering
Chemical and Biological Engineering
Civil Engineering
The Engineering Co-operative Education Program is intended to provide motivated and qualified students with paid, faculty-monitored work experience which is directly related to their academic program. The Co-op Program is available in Biomedical Engineering, Chemical and Biological Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Geological Engineering, Integrated Engineering, Materials Engineering, Mechanical Engineering, Mining Engineering, and Engineering Physics.

URL:  [http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,990,0](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,195,990,0)

**English Requirement**

The Faculty of Applied Science recognizes that good communication skills in English are essential to the understanding of course material and to the successful practice of engineering. To qualify for the B.A.Sc., a student must complete ENGL 112 (or equivalent) and an approved technical communication course. Students admitted directly from secondary schools are required to take English in their first year if eligible to do so. To be eligible, students must have met the Language Proficiency Index Requirement for First-Year English. Once admitted to UBC, students will not normally be permitted to take English requirements at another institution. Students should take particular notice of the English requirements for

URL:  [http://www.calendar.ubc.ca/Vancouver/index.cfm?tree=12,195,272,30](http://www.calendar.ubc.ca/Vancouver/index.cfm?tree=12,195,272,30)
satisfy the English requirements at another institution. Students should take particular notice of the English requirements for advancement in the Faculty (see Advancement).

Note that students who plan on applying to medical school will need 6 credits in ENG in order to apply. Students should confirm application requirements with the medical schools of their choice and may need to take an additional ENGL course as one of their humanities and social sciences electives.

Complementary Studies Courses

In order to satisfy accreditation requirements, all students must complete seven elements of complementary studies, including a minimum of 20 credits of complementary studies courses as follows:

1. Engineering economics: minimum 3 credits
2. Impact of technology on society: minimum 3 credits
3. Humanities and social sciences electives: minimum 6 credits*
4. Communication: minimum 6 credits
5. Health and safety**
6. Professional ethics, equity and law: minimum 2 credits
7. Sustainable development and environmental stewardship**

*Students need 6 credits in ENG in order to apply to medical school. Students should confirm application requirements with the medical schools of their choice and may need to take an additional ENGL course as one of their humanities and social sciences electives if they intend to apply to medical school.

**Content integrated into the core courses of each program

Some of the 20 credits of course requirements shown above may be integrated into core courses of some programs. For up to date lists of acceptable courses in each area of study, as well as program specific information on complementary studies requirements, please consult the Applied Science Engineering Student Services Electives web page.
shown above may be integrated into core courses of some programs. For up to date lists of acceptable courses in each area of study, as well as program specific information on complementary studies requirements, please consult the Applied Science Engineering Student Services Electives web page.

5. Associated Courses and their Documentation

<table>
<thead>
<tr>
<th>Category: (1)</th>
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</thead>
<tbody>
<tr>
<td>Faculty: Applied Science</td>
</tr>
<tr>
<td>Department: Engineering (Biomedical)</td>
</tr>
<tr>
<td>Faculty Approval Date: Oct 27, 2016</td>
</tr>
<tr>
<td>Effective Session (W or S): S</td>
</tr>
<tr>
<td>Effective Academic Year: 2017</td>
</tr>
</tbody>
</table>

| Date: | Oct 6, 2016 |
| Contact Person: | Elizabeth Croft |
| Phone: | (604) 822-6614 |
| Email: | ecroft@mech.ubc.ca |
### Proposed Calendar Entry:
BMEG 101 (3) Introduction to Biomedical Engineering

Core principles of biomedical engineering from a clinical perspective. Sensors and instrumentation, bioelectric phenomenon, biosignals, physiological modeling, biomechanics, biomaterials, tissue engineering, the principles of and design for medical imaging equipment, clinical engineering, moral and ethical issues. [3-0-0]

Prerequisite: All of PHYS 157, PHYS 158, MATH 100 and MATH 101

### URL:
http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG

### Present Calendar Entry:
N/A

### Type of Action:
new course

### Rationale for Proposed Change:
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. It serves to introduce students to the key principles of biomedical engineering and the clinical perspective, which will frame their knowledge and skill acquisition throughout the program.

☑️ Not available for Cr/D/F grading (undergraduate courses only)

### Rationale for not being available for Cr/D/F:
Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
<table>
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<tr>
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</thead>
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<tr>
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<td></td>
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<tr>
<td>Effective Academic Year: 2017</td>
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</table>

**Proposed Calendar Entry:**
BMEG 102 (2) Biomedical Engineering Lab

Rapid prototyping of mechanical, electrical and electromechanical systems. Building parts with state of the art software and 3-D printing. Use of laboratory equipment and instrumentation. [1-2-0]

Prerequisite: All of PHYS 157 and PHYS 158

Co-requisite: BMEG 101

**URL:**
http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG

**Present Calendar Entry:**
N/A

**Type of Action:**
new course

**Rationale for Proposed Change:**
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. It provides the laboratory foundations essential to understand and advance in biomedical engineering.

✔  Not available for Cr/D/F grading (undergraduate courses only)

**Rationale for not being available for Cr/D/F:**
Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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</tr>
</tbody>
</table>

**Proposed Calendar Entry:**
BMEG 150 (4) The Fundamental Units of Life: From Cells To Systems

The structure and function of cells and how they are organized to generate tissues and organ systems [3-3*-0]

**Prerequisites:** All of BIOL 12 and CHEM 12

**URL:** [http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG](http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG)

**Present Calendar Entry:** N/A

**Type of Action:** new course

**Rationale for Proposed Change:**
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. It provides the biological foundations otherwise not in the engineering program. Although many of the topics in this course overlap with existing courses such as BIOL 112, BIOL 112 is insufficient in meeting the specific needs of the BME cohort. The critical distinction between BMEG 150 and BIOL 112 is that BMEG 150 will focus on mammalian human cell and tissue biology. This clearly different from the focus in BIOL 112 on bacteria as is the inclusion of the analysis of how cells interact to form tissues. Study of cell-cell interaction and tissue architecture in mammalian systems is critical for biomedical engineering and the course will be tailored to the needs of BMEG students, including appropriate quantitative models.

**Not available for Cr/D/F grading (undergraduate courses only)**

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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<td></td>
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<tr>
<td><strong>Effective Academic Year:</strong> 2017</td>
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<tr>
<td><strong>Date:</strong> 6 October 2016</td>
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<tr>
<td><strong>Contact Person:</strong> Elizabeth Croft</td>
<td></td>
</tr>
<tr>
<td><strong>Phone:</strong> (604) 822-6614</td>
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<td><strong>Email:</strong> <a href="mailto:ecroft@mech.ubc.ca">ecroft@mech.ubc.ca</a></td>
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</table>

**Proposed Calendar Entry:**

BMEG 201 (3) Technical Communication for Biomedical Engineers

Report preparation, business correspondence, and oral presentation in biomedical engineering specific cases and projects. Credit will not be granted for both BMEG 201 and APSC 201 [3-0-0]

**Prerequisites:** All of ENGL 112, BMEG 101 and BMEG 102

**URL:**

http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG

**Present Calendar Entry:**

N/A

**Type of Action:**

new course

**Rationale for Proposed Change:**

This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. All engineering students require a technical communication course. While other engineering students take APSC 201, this course is tailored to the specific communications needs in health sciences

☑️ **Not available for Cr/D/F grading (undergraduate courses only)**

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
**Category:** (1)  

| **Faculty:** Applied Science  
**Department:** Engineering (Biomedical)  
**Faculty Approval Date:** Oct 27, 2016  
**Effective Session (W or S):** S  
**Effective Academic Year:** 2017 | **Date:** 6 October 2016  
**Contact Person:** Elizabeth Croft  
**Phone:** (604) 822-6614  
**Email:** ecroft@mech.ubc.ca |
|---|---|
| **Proposed Calendar Entry:**  
BMEG 210 (2) Thermodynamics in Biomedical Engineering  
Work, heat and energy; material and energy balances; the first law and second law of thermodynamics; entropy and process reversibility; availability (energy) analysis; Hess’s Law; thermodynamic properties of fluids; and applications to biomedical systems.  
[2-0-2]  
Prerequisite: CHEM 123 is recommended | **URL:**  
http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG  
**Present Calendar Entry:** N/A  
**Type of Action:** new course  
**Rationale for Proposed Change:**  
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. All engineers should have a foundational course in thermodynamics. The applications specific to biomedical engineering differ from those in other fields so a new course is required.  
- Not available for Cr/D/F grading (undergraduate courses only)  
**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties. |
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<tr>
<td>BMEG 220 (4) Circuits and Electromagnetics with Application to Biomedical Engineering</td>
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</tbody>
</table>

Electromagnetic phenomena in the body; bioinstrumentation; electrostatic and electromagnetic fields, forces, capacitance and inductance; bio-effects of electromagnetic fields; and modelling electrical components of physiological and biomedical systems [3-1-0]

| Prerequisites: All of PHYS 157, PHYS 158, MATH 100, MATH 101, MATH 253 and MATH 256  |
| Co-requisite: MATH 264  |

| URL: [http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG](http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG)  |

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<td>This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. Electrical signal transmission plays a crucial role in many biological systems and instrumentation. No other electrical or electromagnetics courses explore signal transmission in biological systems that is necessary to model electrical components in biomedical systems</td>
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| Not available for Cr/D/F grading (undergraduate courses only)  |

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**Present Calendar Entry:** N/A

**Type of Action:** new course

**Rationale for Proposed Change:**  
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. Biomechanics is foundational in biomedical engineering. There are no current courses that address it.

- Not available for Cr/D/F grading (undergraduate courses only)

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
### Proposed Calendar Entry:

BMEG 250 (4) Cellular Physiology and Biophysics

- Cellular structure and mechanisms of membrane transport, signal transduction, muscle mechanochemistry and neurotransmission. Structure and hierarchical organization up to the level of tissues. Light and electron microscopy. [3-1-0]

- **Prerequisite:** BMEG 150

### URL:


### Present Calendar Entry:

N/A

### Type of Action:

new course

### Rationale for Proposed Change:

This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. BME students need to understand physics as it applies to cells and tissues. It is the second in a series of courses (including 150 and 350), which progressively address physicochemical characteristics of building blocks of the cells and how they organize to form complex systems and how these systems relate to engineering problems and design issues. The connectivity between BMEG 150, 250 and 350 permits detailed, quantitative, design-based instruction that is absent in any other course currently offered at UBC. BMEG 250 builds on the content of BMEG 150.

☑ **Not available for Cr/D/F grading (undergraduate courses only)**

### Rationale for not being available for Cr/D/F:

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**Proposed Calendar Entry:**
BMEG 257 (4) Biomedical Engineering Design I

Engineering design process for medical technologies. Clinical practice, the healthcare system, medical approach to diagnosis, ethics and regulations for clinical trials, medical technology management, medical device development and standards, use of statistics for evaluating medical technologies. [2-4-0]

Prerequisites: All of BMEG 101 and BMEG 102

**URL:**

**Present Calendar Entry:**
N/A

**Type of Action:**
new course

**Rationale for Proposed Change:**
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. Design is a core skill for all engineers. A strength of this program is that it provides substantial opportunity to develop design skill across 3 years.

- Not available for Cr/D/F grading (undergraduate courses only)

**Rationale for not being available for Cr/D/F:**
Undergraduate courses in Engineering are currently not offered for Cr/D/F. This course is not open to students from other faculties.
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| Contact Person: | Elizabeth Croft |
| Phone: | (604) 822-6614 |
| Email: | ecroft@mech.ubc.ca |

**Proposed Calendar Entry:**
BMEG 310 (3) Introduction to Bioinformatics

Principles behind the methods of bioinformatics. The use of bioinformatics databases and tools for solving problems in genomics, proteomics, structural biology and evolutionary biology. [3-0-2*]

Prerequisites: All of BMEG 150 and APSC 160

**URL:**

**Present Calendar Entry:** N/A

**Type of Action:** new course

**Rationale for Proposed Change:**
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. Informatics provides increasingly important tools in all areas of engineering. All BME students should understand the basic principles and applications in the field. Although there are similarities in naming, this course does not duplicate CPSC 445. BMEG 310 develops engineers with the proficiency to use bioinformatics packages, not the ability to develop them or specialize in them as in CPSC 445. BMEG 310 introduces students to the catalogue of tools that are available for analyzing a biomedical problem and then using these tools to charge ahead in their workflow. CPSC 445 addresses design and analysis of algorithms (not the analysis of problems using state-of-the-art tools)

☑ Not available for Cr/D/F grading (undergraduate courses only)

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This course is not open to students from other faculties.
## Proposed Calendar Entry:
BMEG 320 (3) Bioengineering Feedback Systems and Controls

Modeling, analysis and simulation of dynamic systems; system modeling by state space; linearization; feedback, stability and sensitivity; control system design. Examples from biological systems, assistive systems and biomedical equipment [3-0-0]

Prerequisites: All of PHYS 157, MATH 253, MATH 256 and BMEG 220

## URL:
http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG

## Present Calendar Entry:
N/A

## Type of Action:
new course

## Rationale for Proposed Change:
This course will be offered as a mandatory technical elective in Biomedical Systems and Signals Stream in the new Bachelor of Applied Science in Biomedical Engineering program. It provides the background necessary to model physiological and biomedical systems and to understand principles and use of feedback in analysis and design, that is important in this area

- Not available for Cr/D/F grading (undergraduate courses only)

## Rationale for not being available for Cr/D/F:
Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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**Proposed Calendar Entry:**

BMEG 330 (3) Biomechanics II

Principles and common elements of sports-, orthopaedic-, injury- and cellular length-biomechanics. Improving sports performance and preventing overuse injuries through sports biomechanics, designing orthopaedic implants through orthopaedic biomechanics, preventing injuries through injury biomechanics and identifying and filtering cancerous blood cells through cellular biomechanics. [3-0-1]

**Prerequisite:** BMEG 230

**URL:** [http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG](http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG)

**Present Calendar Entry:** N/A

**Type of Action:** new course

**Rationale for Proposed Change:**

This course will be offered as a mandatory technical elective in Biomechanics and Biomaterials stream the in the new Bachelor of Applied Science in Biomedical Engineering program. It provides key foundational skills and knowledge of the breadth of approaches used in sports-, orthopaedic-, injury- and cellular-biomechanical engineering

☑ **Not available for Cr/D/F grading (undergraduate courses only)**

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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<td>BMEG 350 (4) Human Structure/Function from Cells to Systems</td>
<td>Type of Action: new course</td>
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<td>Human anatomy, histology and physiology with examples from biomedical engineering. Anatomical compartmentation and function regulation; homeostatic control systems, sensors and effectors; intercellular communication strategies; and cellular and organ function assessment [4-0-0]</td>
<td>Rationale for Proposed Change: This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. All BME students should have an integrated understanding of micro- and macro- structures and functions. It is the third in a series of courses (including 150 and 250), which progressively address physicochemical characteristics of building blocks of the cells and how they organize to form complex systems and how these systems relate to engineering problems and design issues. The connectivity between BMEG 150, 250 and 350 permits detailed, quantitative, design-based instruction that is conspicuously absent in any other course currently offered at UBC.</td>
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<td>Rationale for not being available for Cr/D/F: Undergraduate courses in Engineering are currently not offered for Cr/D/F. This course is not open to students from other faculties.</td>
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### Proposed Calendar Entry:

**BMEG 357 (3) Biomedical Engineering Design II**

Creating innovations in medical technologies. Case studies in need clinical identification. Supervised design process, building and testing prototypes with potential users. [3*-3*-0]

**Prerequisite:** BMEG 257

### URL:


### Present Calendar Entry:

N/A

### Type of Action:

new course

### Rationale for Proposed Change:

This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. A strength of this program is the substantial opportunity to develop design skills over 3 years. This is the second in the series of design courses.

- Not available for Cr/D/F grading (undergraduate courses only)

### Rationale for not being available for Cr/D/F:

Undergraduate courses in Engineering are currently not offered for Cr/D/F. This course is not open to students from other faculties.
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**Email:** ecroft@mech.ubc.ca

**Proposed Calendar Entry:**  
BMEG 370 (3) Cellular Responses to Forces and Biomaterials  
Mechanical forces and biomaterials regulating cellular functions critical to tissue development, regeneration and repair. [3-0-0]  
**Prerequisites:** All of BMEG 150, BMEG 250 and BMEG 350

**URL:** [http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG](http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG)

**Present Calendar Entry:** N/A

**Type of Action:** new course

**Rationale for Proposed Change:**  
This course is intended to be an Optional Technical Elective course in the Cellular Bioengineering Stream of the new Bachelor of Applied Science in Biomedical Engineering program. This will be a foundational and important course for any BME student who will work with biomaterials and/or tissue regeneration.

- **Not available for Cr/D/F grading (undergraduate courses only)**

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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**Proposed Calendar Entry:**
BMEG 371 (3) Transport Phenomena within Cells and Tissues

Fluid flow and mass transport analysis within healthy and diseased cells and tissues using mathematics. Drug delivery and tissue engineering. [3-0-2*]

**Prerequisites:** All of MATH 100, MATH 101, MATH 253 and MATH 256

**URL:**

**Present Calendar Entry:**
N/A

**Type of Action:**
new course

**Rationale for Proposed Change:**
This course is intended to be an Optional Technical Elective course in the Cellular Bioengineering Stream of the new Bachelor of Applied Science in Biomedical Engineering program. Students who will work in drug delivery or tissue engineering will find it particularly useful

☑ Not available for Cr/D/F grading (undergraduate courses only)

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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**Proposed Calendar Entry:**
BMEG 372 (3) Biomedical Materials and Drug Delivery

Biomaterials science/engineering applied to design and synthesis of drug delivery systems. Biomaterial types, synthesis and testing; the use of biomaterials; biological response; biocompatibility and degradation; drug delivery systems; nanocarriers; modification of polymers; liposomes and micelles; nucleic acid, transdermal and oral delivery. [3-0-0]

Prerequisites: All of BMEG 150, BMEG 250 and CHEM 123

**URL:**
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**Present Calendar Entry:**
N/A

**Type of Action:**
new course

**Rationale for Proposed Change:**
This will be an optional technical elective course in the Cellular Bioengineering Stream of the new Bachelor of Applied Science in Biomedical Engineering program. Students who will work in drug delivery and biomaterials will find it foundational

☑ Not available for Cr/D/F grading (undergraduate courses only)

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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Proposed Calendar Entry:
BMEG 373 (3) Microfluidics

Advantages and disadvantages of miniaturization of complex fluid flow processes. Manipulating liquid flow; electrophoretic velocity and mobility; serial dilution; capillary electrophoresis; integrated microfluidic platforms; and blood and the motility of bacteria. [3-0-0]

Prerequisite:  CHBE 251

URL:  http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG

Present Calendar Entry:  N/A

Type of Action:  new course

Rationale for Proposed Change:
This will be an optional technical elective course in the Cellular Bioengineering stream of the new Bachelor of Applied Science in Biomedical Engineering program. Fluid flows at the cellular level have unique properties. These concepts are particularly important in understanding biological behaviour at the cellular scale. Students who will work at this scale will need this background

☑ Not available for Cr/D/F grading (undergraduate courses only)

Rationale for not being available for Cr/D/F: Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
**Proposed Calendar Entry:**
BMEG 390 (3) Medical Imaging

Physical principles of ultrasound, magnetic resonance, computed tomography, X-ray projection imaging and molecular imaging in medical imaging for diagnostics, therapeutics and interventions. [3-0-0]

**Prerequisites:** All of BMEG 220, BMEG 250 and ELEC 371

**URL:**
http://www.calendar.ubc.ca/vancouver/courses.cfm?page=code&institution=2&code=BMEG

**Present Calendar Entry:**
N/A

**Type of Action:**
new course

**Rationale for Proposed Change:**
This course will be offered as an optional technical elective in both the Biomechanical Systems and Signals stream and the Biomedical Informatics stream in the new Bachelor of Applied Science in Biomedical Engineering program. Changing technologies in medical imaging require engineers with a solid foundation in medical imaging

☑ Not available for Cr/D/F grading (undergraduate courses only)

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
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**Proposed Calendar Entry:**
BMEG 430 (3) Economics of Healthcare Solutions

Canadian and USA engineering economics in BME and healthcare systems. Economic equivalence, cost estimation, risk assessment, regulatory frameworks, economic optimization, intangible factors, ethics, sustainability, financial tools, commercialization and regulator regimes. [3-0-0]

**Present Calendar Entry:**
N/A

**Type of Action:**
new course

**Rationale for Proposed Change:**
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. For accreditation, all engineers require a course in economics in their field. Economics of Healthcare systems will help students navigate and identify suitable opportunities for innovation.

- **Not available for Cr/D/F grading**
  (undergraduate courses only)

**Rationale for not being available for Cr/D/F:** Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
### Proposed Calendar Entry:
BMEG 450 (6) Biomedical Engineering Design Project

Capstone design and development of a practical biomedical device or system. Projects provided by local industry and engineering research laboratories [1-3-1; 1-3-1]

Prerequisite: BMEG 350

### Present Calendar Entry:
N/A

### Type of Action:
new course

### Rationale for Proposed Change:
This will be a required course in the new Bachelor of Applied Science in Biomedical Engineering program. A strength of this program is its substantial opportunity to develop skills in design over 3 years. This course allows the student to apply all the design skills they’ve learned to an authentic engineering project. As a final-year culminating project, the majority of the time the student devotes to this project will be unscheduled research, design and development and not specifically in lectures or structured lab activities.

- Not available for Cr/D/F grading (undergraduate courses only)

### Rationale for not being available for Cr/D/F:
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</tbody>
</table>

**Proposed Calendar Entry:**  
BMEG 474 (3) Stem Cells and Regenerative Medicine  
Biology and applications of stem cells in regenerative medicine. Modeling human biology and disease in vitro and in vivo. Regulatory and commercialization pathways for regenerative medicine innovations. [3-0-0]  
Prerequisites: All of BMEG 150, BMEG 250 and BMEG 350  
URL:  

**Present Calendar Entry:**  
N/A  
**Type of Action:**  
new course  

**Rationale for Proposed Change:**  
This will be an optional technical elective in the Cellular Bioengineering Stream of the Bachelor of Applied Science in Biomedical Engineering program. Regenerative medicine is a growing and leading-edge area of biomedical engineering and some students will take on careers in the field.  

- **Not available for Cr/D/F grading**  
  (undergraduate courses only)  

**Rationale for not being available for Cr/D/F:**  
Undergraduate courses in Engineering are currently not offered for Cr/D/F. This is course is not open to students from other faculties.
### Proposal Appendices

#### Appendix 1: Biomedical Engineering Program Advisory Committee Composition

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike Allard</td>
<td>Head</td>
<td>Pathology</td>
</tr>
<tr>
<td>Sandra Jarvis-Selinger</td>
<td>Associate Dean, Academic</td>
<td>Pharmaceutical Sciences</td>
</tr>
<tr>
<td>Thomas Oxland</td>
<td>Professor</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Elizabeth Croft (coChair)</td>
<td>Associate Dean, Education and Professional Development</td>
<td>Applied Science</td>
</tr>
<tr>
<td>Vikram Yadav</td>
<td>Assistant professor</td>
<td>Chemical and Biological Engineering</td>
</tr>
<tr>
<td>Peter Cripton</td>
<td>Professor</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Fabio Rossi</td>
<td>Professor</td>
<td>Department of Medical Genetics</td>
</tr>
<tr>
<td>Roger Brownsey</td>
<td>Head</td>
<td>Biochemistry &amp; Molecular Biology</td>
</tr>
<tr>
<td>Tim Salcudean</td>
<td>Professor</td>
<td>Electrical and Computer Engineering</td>
</tr>
<tr>
<td>Rob Rohling</td>
<td>Professor</td>
<td>Electrical and Computer Engineering</td>
</tr>
<tr>
<td>Carol Jaeger</td>
<td>Associate Dean, Academic</td>
<td>Applied Science</td>
</tr>
<tr>
<td>Shyh-Dar Li</td>
<td>Associate Professor</td>
<td>Pharmaceutical Sciences</td>
</tr>
<tr>
<td>Antony Hodgson</td>
<td>Professor &amp; Director of Biomed Eng Grad Program</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Niamh Kelly</td>
<td>Associate Professor</td>
<td>Pathology</td>
</tr>
<tr>
<td>Scott Covey</td>
<td>Senior Instructor</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Jamie Piret</td>
<td>Professor</td>
<td>Chemical and Biological Engineering</td>
</tr>
<tr>
<td>Warren Williams</td>
<td>Instructor</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Rob McMaster (coChair)</td>
<td>Associate Dean, Research</td>
<td>Medicine</td>
</tr>
<tr>
<td>Pieter Cullis</td>
<td>Professor</td>
<td>Department of Biochemistry and Molecular Biology</td>
</tr>
<tr>
<td>Carrie Hunter</td>
<td>Curriculum consultant</td>
<td>CTLT</td>
</tr>
<tr>
<td>Marc Parlane</td>
<td>Dean</td>
<td>Applied Science</td>
</tr>
<tr>
<td>Dermot Kelleher</td>
<td>Dean</td>
<td>Medicine</td>
</tr>
<tr>
<td>Michale Coughtrie</td>
<td>Dean</td>
<td>Pharmaceutical Sciences</td>
</tr>
<tr>
<td>Jocelyn Beretta</td>
<td>Exec Assistant to Dean</td>
<td>Pharmaceutical Sciences</td>
</tr>
<tr>
<td>Edwin Moore</td>
<td>Interim Head</td>
<td>Cellular &amp; Physiological Sciences</td>
</tr>
</tbody>
</table>
Appendix 2: Industry and Labour Market Reports


Western GTA Consortium (2004). Toronto Biotechnology Cluster Strategy

### Appendix 3: Sample Lower Mainland Biomedical Companies

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>McKesson</td>
<td>Imaging, informatics and workflow solutions for hospitals - 850 employees (#11 Technology company in BC)</td>
<td></td>
</tr>
<tr>
<td>Stemcell Technologies</td>
<td>Cell separation, culture media, antibodies, instruments, education and contract assay services 515 BC Staff (#15 Technology company in BC)</td>
<td></td>
</tr>
<tr>
<td>Point Grey Research</td>
<td>Design/manufacture digital cameras for life sciences and other applications – 234 BC Staff (#31 Technology company in BC)</td>
<td></td>
</tr>
<tr>
<td>Arbutus Biopharma</td>
<td>RNA Interference therapeutics to treat disease – 134 BC Staff (#53 Technology company in BC)</td>
<td></td>
</tr>
<tr>
<td>Kardium</td>
<td>Global mapping and ablation system, investigational medical device used in the diagnosis and treatment of atrial fibrillation – 115 BC Staff (#61 Technology company in BC)</td>
<td></td>
</tr>
<tr>
<td>Zymeworks Inc</td>
<td>Biotherapeutics for cancers and autoimmune and inflammatory diseases using a predictive computational protein engineering platform – 90 BC Staff (#69 Technology company in BC)</td>
<td></td>
</tr>
<tr>
<td>QImaging</td>
<td>Scientific cameras for Life Science and other applications – 65 BC Staff (#91 Technology company in BC)</td>
<td></td>
</tr>
<tr>
<td>MedTech</td>
<td>Merged to Life Sciences BC (pharma focus)</td>
<td></td>
</tr>
<tr>
<td>Clari-us</td>
<td>Miniature ultrasound for primary care</td>
<td></td>
</tr>
<tr>
<td>Lung Pacer</td>
<td>Technology to shorten ICU stays</td>
<td></td>
</tr>
<tr>
<td>NeoVasc</td>
<td>Develops and manufactures cardiovascular devices -200 employees</td>
<td></td>
</tr>
<tr>
<td>Leva-Nova</td>
<td>Specializing in Cardiac surgery, neuromodulation and Cardiac Rhythm Management technologies</td>
<td></td>
</tr>
<tr>
<td>Creation Technologies</td>
<td>Customized technology</td>
<td></td>
</tr>
<tr>
<td>Precision Nano Systems</td>
<td>Nanotechnology solutions for molecular understanding and treatment of disease</td>
<td></td>
</tr>
<tr>
<td>Response Biomedical</td>
<td>Develops and manufactures a diagnostics platform that delivers lab quality performance for patient management in acute care</td>
<td></td>
</tr>
<tr>
<td>Rostrom</td>
<td>Develops and refines links between medicine and biomedical engineering with innovative products (respiratory enthalpy monitoring for mechanically ventilated patients)</td>
<td></td>
</tr>
<tr>
<td>Analogics</td>
<td>Developing enabling technologies used in computed tomography (CT), ultrasound, digital mammography (DM), and magnetic resonance imaging (MRI)</td>
<td></td>
</tr>
<tr>
<td>Angiotech</td>
<td>Medical devices for implants, surgical interventions and injury</td>
<td></td>
</tr>
<tr>
<td>IND Diagnostics</td>
<td>Original Equipment Manufacturer of in vitro diagnostic test kits</td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Coastal Genomics</td>
<td>Genomics</td>
<td></td>
</tr>
<tr>
<td>GE Healthcare</td>
<td>Expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, biopharmaceutical manufacturing technologies, performance improvement and performance solutions services</td>
<td></td>
</tr>
<tr>
<td>Innovatek</td>
<td>Manufacturer of diagnostic kits</td>
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</tr>
<tr>
<td>Bioasis</td>
<td>Development and commercialization of a platform for delivery across the blood brain barrier in the treatment of neurological disorders</td>
<td></td>
</tr>
<tr>
<td>Mati Therapeutics</td>
<td>Developing ocular drug delivery systems</td>
<td></td>
</tr>
<tr>
<td>Acuitas Therapeutics</td>
<td>Delivery solutions for molecular therapeutics using lipid nanoparticles</td>
<td></td>
</tr>
</tbody>
</table>
# Appendix 4: Faculty Expertise in Biomedical Engineering

<table>
<thead>
<tr>
<th>Projects and Areas of Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mu Chiao</strong></td>
</tr>
<tr>
<td><strong>Peter Cripton</strong></td>
</tr>
<tr>
<td><strong>Agnes d’Entremont</strong></td>
</tr>
<tr>
<td><strong>Dana Grecov</strong></td>
</tr>
<tr>
<td><strong>Antony J. Hodgson</strong></td>
</tr>
<tr>
<td><strong>Hongshen Ma</strong></td>
</tr>
<tr>
<td><strong>Thomas Oxland</strong></td>
</tr>
<tr>
<td><strong>Srikantha Phani</strong></td>
</tr>
<tr>
<td><strong>Robert N. Rohling</strong></td>
</tr>
<tr>
<td><strong>Douglas Romilly</strong></td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Boris Stoeber</td>
</tr>
<tr>
<td>Machiel Van der Loos</td>
</tr>
<tr>
<td>David R. Wilson</td>
</tr>
<tr>
<td>Tim Salcudean</td>
</tr>
<tr>
<td>Purang Abolmaesumi</td>
</tr>
<tr>
<td>Rafeef Abugharbieh</td>
</tr>
<tr>
<td>Karen Cheung</td>
</tr>
<tr>
<td>Lukas Chrostowski</td>
</tr>
<tr>
<td>Edmond Cretu</td>
</tr>
<tr>
<td>Guy Dumont</td>
</tr>
<tr>
<td>Sid Fels</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>Mehdi Moradi</td>
</tr>
<tr>
<td>Leo Stocco</td>
</tr>
<tr>
<td>Kenichi Takahata</td>
</tr>
<tr>
<td>Shuo Tang</td>
</tr>
<tr>
<td>Robin Turner</td>
</tr>
<tr>
<td>Konrad Walus</td>
</tr>
<tr>
<td>Jane Z. Wang</td>
</tr>
</tbody>
</table>
## Appendix 5: Curriculum Proposal

<table>
<thead>
<tr>
<th>Courses</th>
<th>Core</th>
<th>CREDITS</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>APSC 100</td>
<td>BME Core</td>
<td>3</td>
<td>Introduction to Engineering I</td>
</tr>
<tr>
<td>CHEM 121</td>
<td>BME Core</td>
<td>4</td>
<td>Structural Chemistry</td>
</tr>
<tr>
<td>MATH 100</td>
<td>BME Core</td>
<td>3</td>
<td>Differential calculus with applications to physical sciences and engineering</td>
</tr>
<tr>
<td>PHYS 157</td>
<td>BME Core</td>
<td>3</td>
<td>Introductory Physics for engineers I</td>
</tr>
<tr>
<td>PHYS 170</td>
<td>BME Core</td>
<td>3</td>
<td>Mechanics I</td>
</tr>
<tr>
<td>APSC 160</td>
<td>BME Core</td>
<td>3</td>
<td>Introduction to Computer engineering design</td>
</tr>
<tr>
<td>MATH 101</td>
<td>BME Core</td>
<td>3</td>
<td>Integral calculus with applications to physical sciences and engineering</td>
</tr>
<tr>
<td>MATH 152</td>
<td>BME Core</td>
<td>3</td>
<td>Linear Systems</td>
</tr>
<tr>
<td>PHYS 158</td>
<td>BME Core</td>
<td>3</td>
<td>Introductory physics for engineers II</td>
</tr>
<tr>
<td>BMEG 150</td>
<td>BME Core</td>
<td>4</td>
<td>The Fundamental Units of Life: From Cells to Systems</td>
</tr>
<tr>
<td>CHEM 123</td>
<td>BME Core</td>
<td>4</td>
<td>Thermodynamics, kinetics and organic chemistry</td>
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</table>

### WINTER SESSION CREDITS 36

<table>
<thead>
<tr>
<th>Courses</th>
<th>Core</th>
<th>CREDITS</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>ENGL 112</td>
<td>BME Core</td>
<td>3</td>
<td>Strategies for University Writing</td>
</tr>
<tr>
<td>BMEG 101</td>
<td>BME Core</td>
<td>3</td>
<td>Introduction to Biomedical Engineering</td>
</tr>
<tr>
<td>BMEG 210</td>
<td>BME Core</td>
<td>2</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>BMEG 220</td>
<td>BME Core</td>
<td>4</td>
<td>Circuits &amp; electromagnetics with applications to bioengineering</td>
</tr>
<tr>
<td>MATH 264</td>
<td>BME Core</td>
<td>1</td>
<td>Vector calculus for electrical engineering</td>
</tr>
</tbody>
</table>

### SUMMER YEAR 1 (6 WEEK SESSION)

<table>
<thead>
<tr>
<th>Courses</th>
<th>Core</th>
<th>CREDITS</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEG 102</td>
<td>BME Core</td>
<td>2</td>
<td>Biomedical Engineering Lab</td>
</tr>
</tbody>
</table>

### YEAR CREDITS 44

<table>
<thead>
<tr>
<th>Courses</th>
<th>Core</th>
<th>CREDITS</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 253 or MATH 226</td>
<td>BME Core</td>
<td>3</td>
<td>Multivariable Calculus or Advanced Calculus I</td>
</tr>
<tr>
<td>BMEG 210</td>
<td>BME Core</td>
<td>2</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>BMEG 220</td>
<td>BME Core</td>
<td>4</td>
<td>Circuits &amp; electromagnetics with applications to bioengineering</td>
</tr>
<tr>
<td>MATH 264</td>
<td>BME Core</td>
<td>1</td>
<td>Vector calculus for electrical engineering</td>
</tr>
<tr>
<td>Course Code</td>
<td>Core Level</td>
<td>Credits</td>
<td>Course Title</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
<td>---------</td>
<td>--------------</td>
</tr>
<tr>
<td>BMEG 250</td>
<td>Core 4</td>
<td>4</td>
<td>Cell physiology and biophysics</td>
</tr>
<tr>
<td>CHBE 251</td>
<td>Core 3</td>
<td>3</td>
<td>Transport Phenomenon</td>
</tr>
<tr>
<td>BMEG 230</td>
<td>Core 4</td>
<td>4</td>
<td>Biomechanics</td>
</tr>
<tr>
<td>BME 201</td>
<td>Core 3</td>
<td>3</td>
<td>Technical Communications for Biomedical Engineers</td>
</tr>
<tr>
<td>MATH 256</td>
<td>Core 3</td>
<td>3</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>CPEN 221</td>
<td>Core 4</td>
<td>4</td>
<td>Principles of Software Construction</td>
</tr>
<tr>
<td>BMEG 257</td>
<td>Core 4</td>
<td>4</td>
<td>Biomedical Engineering Design I</td>
</tr>
<tr>
<td>CHEM 235</td>
<td>Core 1</td>
<td>1</td>
<td>Organic Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>Core 3</td>
<td>3</td>
<td>Organic Chemistry for Biological Sciences</td>
</tr>
<tr>
<td>BIOC 202</td>
<td>Core 3</td>
<td>3</td>
<td>Introductory Medical Biochemistry</td>
</tr>
<tr>
<td>ELEC 371</td>
<td>Core 3</td>
<td>3</td>
<td>Biomedical Engineering Instrumentation</td>
</tr>
<tr>
<td>BMEG 350</td>
<td>Core 4</td>
<td>4</td>
<td>Human Structure/Function from Cells to Systems</td>
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<tr>
<td>BMEG 357</td>
<td>Core 3</td>
<td>3</td>
<td>Biomedical Engineering Design II</td>
</tr>
<tr>
<td>STAT 251</td>
<td>Core 3</td>
<td>3</td>
<td>Elementary and Probability Statistics</td>
</tr>
<tr>
<td>CHBE 351</td>
<td>Core 3</td>
<td>3</td>
<td>Transport Phenomenon II</td>
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</table>

YEAR CREDITS: **35**

YEAR 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Core Level</th>
<th>Credits</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 235</td>
<td>Core 1</td>
<td>1</td>
<td>Organic Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>Core 3</td>
<td>3</td>
<td>Organic Chemistry for Biological Sciences</td>
</tr>
<tr>
<td>BIOC 202</td>
<td>Core 3</td>
<td>3</td>
<td>Introductory Medical Biochemistry</td>
</tr>
<tr>
<td>ELEC 371</td>
<td>Core 3</td>
<td>3</td>
<td>Biomedical Engineering Instrumentation</td>
</tr>
<tr>
<td>BMEG 350</td>
<td>Core 4</td>
<td>4</td>
<td>Human Structure/Function from Cells to Systems</td>
</tr>
<tr>
<td>BMEG 310</td>
<td>Core 3</td>
<td>3</td>
<td>Introduction to Biomedical Informatics tools, biological databases &amp; data visualization</td>
</tr>
<tr>
<td>STAT 251</td>
<td>Core 3</td>
<td>3</td>
<td>Elementary and Probability Statistics</td>
</tr>
<tr>
<td>CHBE 351</td>
<td>Core 3</td>
<td>3</td>
<td>Transport Phenomenon II</td>
</tr>
<tr>
<td>BMEG 357</td>
<td>Core 3</td>
<td>3</td>
<td>Biomedical Engineering Design II</td>
</tr>
</tbody>
</table>

This 1-semester course will give students an experiential introduction to the process of creating innovations in medical technologies. It uses case studies to illustrate the early phases of need identification and a supervised design process to conceive of solutions to an identified clinical need, build a prototype to address the need and test the prototype with potential users of the solution.

YEAR CREDITS: **38**
This 2-semester capstone design project is designed to give students experience in the design and development of practical biomedical devices and systems. Projects are provided by local industry and engineering research laboratories.

This course covers the fundamentals of engineering economics, with particular attention to biomedical engineering considerations. It focuses on the economic aspects of engineering decision-making processes, primarily through the comparison of different process alternatives. Topics to be covered include economic equivalence of different options, interest rate calculations, capital and operating cost estimation, risk assessment, regulatory frameworks, and economic optimization. Intangible factors, ethics, and sustainability and their roles in the decision-making process are discussed. Financial tools, market forces, regulator regimes and the role of politics in decision-making are also presented. Special attention will be given to relevant economics of Canadian and USA healthcare systems and the biomedical technology industry. Commercialization of biomedical products will also be introduced.

BMEG 456 BME Core 3 Clinical and Industrial biomedical engineering
STAT 300 BME Core 3 Intermediate Statistics for Applications

3 Complementary Studies Electives*

18 Stream Based Technical Electives

Program Credits 153

*Note: students intending to apply to medical school may require an additional ENGL course and may wish to include same to fulfill their complementary studies requirements. For further details on complementary studies requirements please see http://www.calendar.ubc.ca/Vancouver/index.cfm?tree=12,195,272,30.
Appendix 6: Streams and Technical Electives

Four streams of technical electives are possible in the BME program. Students in each stream take a set of Core Electives (CEs) and select additional optional technical electives in consultation with departmental advisors. The number of required credits of TEs is noted such that the total number of technical elective credits is 27.

### Cellular Bioengineering

<table>
<thead>
<tr>
<th>Title</th>
<th>Code</th>
<th>CE or TE (13 Credits)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Chemical Analysis</td>
<td>CHEM 211</td>
<td>CE</td>
<td>4</td>
</tr>
<tr>
<td>Bioprocess engineering</td>
<td>CHBE 381</td>
<td>CE</td>
<td>3</td>
</tr>
<tr>
<td>Biomed equipment, physiology and anatomy</td>
<td>BMEG 410</td>
<td>CE</td>
<td>4</td>
</tr>
<tr>
<td>General Biochemistry</td>
<td>BIOC 302</td>
<td>CE</td>
<td>3</td>
</tr>
<tr>
<td>Effects of forces and biomaterials on cells</td>
<td>BMEG 370</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Transport phenomena within cells and tissues</td>
<td>BMEG 371</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Biomed materials &amp; Drug Delivery</td>
<td>BMEG 372</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Microfluidics</td>
<td>BMEG 373</td>
<td>TE</td>
<td>3</td>
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<tr>
<td>New Venture Design</td>
<td>APSC 486</td>
<td>TE</td>
<td>6</td>
</tr>
<tr>
<td>Technology entrepreneurship for engineers</td>
<td>APSC 541</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Protein structure &amp; functions</td>
<td>BIOC 402</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Enzymology</td>
<td>BIOC 403</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Regenerative medicine</td>
<td>BMEG 474</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Advanced cellular &amp; molecular physiology</td>
<td>CAPS 421</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Advanced bioprocess engineering</td>
<td>CHBE 481</td>
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<td>Immunology</td>
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<td>Molecular virology</td>
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<td>Molecular &amp; cell biology of cancer</td>
<td>PATH 531</td>
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<td>Pain research &amp; therapy</td>
<td>PHAR 440</td>
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<td>Nanomedicine</td>
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### Biomechanics and Biomaterials

<table>
<thead>
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<tr>
<td>Engineering Materials</td>
<td>APSC 278</td>
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<tr>
<td>Introduction to Mechanics of Materials</td>
<td>MECH 260</td>
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<td>3</td>
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<tr>
<td>Biomechanics</td>
<td>BMEG 330</td>
<td>CE</td>
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</tr>
<tr>
<td>New Ventures Design</td>
<td>APSC 486</td>
<td>TE</td>
<td>6</td>
</tr>
<tr>
<td>Technology Entrepreneurship for Engineers</td>
<td>APSC 541</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>General Biochemistry</td>
<td>BIOC 302</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>Digital Systems and Microcomputers</td>
<td>CPEN 312</td>
<td>TE</td>
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<tr>
<td>Orthopaedic Biomechanics</td>
<td>MECH 435</td>
<td>TE</td>
<td>3</td>
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<tr>
<td>Fundamentals of Injury Biomechanics</td>
<td>MECH 436</td>
<td>TE</td>
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<td>Finite Element Analysis</td>
<td>MECH 462</td>
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<td>Dynamic System Models</td>
<td>MECH 469</td>
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<tr>
<td>Biomaterials</td>
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# Biomedical Systems and Signals

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<td>Signals and Systems</td>
<td>ELEC 221</td>
<td>CE</td>
<td>4</td>
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<td>New Venture Design</td>
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<tr>
<td>Mathematical Proof</td>
<td>MATH 220</td>
<td>TE</td>
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</tr>
<tr>
<td>Models of Computation</td>
<td>CPSC 121</td>
<td>TE</td>
<td>4</td>
</tr>
<tr>
<td>Basic Algorithms and Data Structures</td>
<td>CPSC 221</td>
<td>TE</td>
<td>4</td>
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<tr>
<td>Technology Entrepreneurship for Engineers</td>
<td>APSC 541</td>
<td>TE</td>
<td>3</td>
</tr>
<tr>
<td>General Biochemistry</td>
<td>BIOC 302</td>
<td>TE</td>
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<tr>
<td>Bioprocess engineering</td>
<td>CHBE 381</td>
<td>TE</td>
<td>4</td>
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<tr>
<td>Medical Imaging</td>
<td>BMEG 390</td>
<td>TE</td>
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<tr>
<td>Biomed equipment, physiology and anatomy</td>
<td>BMEG 410</td>
<td>TE</td>
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<tr>
<td>Principles of Software Construction</td>
<td>CPEN 221</td>
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<td>Digital Systems and Microcomputers</td>
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<tr>
<td>Machine Learning and Data Mining</td>
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<td>Biosignals and Systems</td>
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<td>Introduction to Robotics</td>
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<td>Sensors and Actuators in Microsystems</td>
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<td>Micro/Nanofabrication and Instrumentation</td>
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<td>Laboratory</td>
<td>ELEC 464</td>
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<td>Nanotechnology and Nature</td>
<td>ELEC 465</td>
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<td>Microsystems Design</td>
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<td>Biological Micro-Electro-Mechanical Systems</td>
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# BioMedical Informatics

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<td>or Models of Computation</td>
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<tr>
<td>Basic Algorithms and Data Structures</td>
<td>CPSC 221</td>
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<td>New Venture Design</td>
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<td>Technology Entrepreneurship for Engineers</td>
<td>APSC 541</td>
<td>TE</td>
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<tr>
<td>Bioprocess engineering</td>
<td>CHBE 381</td>
<td>TE</td>
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<tr>
<td>Medical Imaging</td>
<td>BMEG 390</td>
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<tr>
<td>Software Engineering</td>
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<td>Software Project Management</td>
<td>CPEN 421</td>
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<td>3</td>
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<td>Human Computer Interfaces in Engineering Design</td>
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<td>Scientific Computing</td>
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<td>Numerical Computation for Algebraic Problems</td>
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<td>Introduction to Relational Databases</td>
<td>CPSC 304</td>
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<td>Introduction to AI</td>
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<td>CPSC 410</td>
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<td>Artificial Intelligence 2 - Intelligent Systems</td>
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<td>Computer Vision</td>
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<td>Advanced Methods for HCI</td>
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<td>Algorithms for Bioinformatics</td>
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<td>Signals and Systems</td>
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<td>Computer Communications</td>
<td>ELEC 331</td>
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<td>Sensors and Actuators in Microsystems</td>
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<tr>
<td>Methods for Statistical Learning</td>
<td>STAT 406</td>
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*for a total of 27 credits of technical electives*
Appendix 7: Integrated Experiential Learning Schedule (Open Coop and Coordinated International Exchange):

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Fall (Sept-Dec)</th>
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<tr>
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<td>study</td>
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2 November 2016

To: Senate
From: Nominating Committee
Re: Committee Appointments

A) Appointments to the President’s Advisory Committee for the Selection of a Vice-President Academic & Provost

The Senate Nominating Committee has received a request from President Ono to appoint four persons to an advisory committee being formed pursuant to Joint Board-Senate Policy 18. Two of those persons must be students or faculty members, 1 must be a faculty member, and 1 must be a dean or principal. The Committee notes that under that policy additional members are appointed by the Board of Governors and elected by the students. In addition to those names developed by the Committee, in response to a call for additional nominations made to all faculty members and students of UBC, an additional four faculty members and one student put their names forward for consideration. Personal statements were sought from all nominees, including those developed by the committee. A list of all those nominated as well as their statements are available from the Committee’s secretary.

In considering recommendations to Senate, the Senate Nominating Committee considered its traditional criteria in making recommendations. For the information of Senate, these are:

- Past and current service experiences and background, including but not limited to search/hiring committee experience
- Familiarity with UBC, the position in question, academic governance, and post-secondary educational administration
- Discipline and demographic balance

The Committee has considered possible appointees, and is pleased to recommend:

That Dr Perry Adebar, Dr Sian Echard, Dr Janice Eng, and Dean John Innes be appointed to the President’s Advisory Committee for the Selection of a Vice-President Academic & Provost.

Professor Perry Adebar is an expert on the earthquake design of high-rise buildings. The results of his group’s research at UBC over the past 25 years have had a defining influence on the Canadian building code, and he has been a consultant on the design of a number of unique buildings in Canada and the United States. Professor Adebar is a UBC Killam Teaching Prize winner. He is currently Head of the Department of Civil Engineering, and was previously an Associate Dean of the Faculty of Applied Science for nine years. Perry Adebar is in his 15th year as a member of the UBC Senate, and is
currently a representative of the Joint Faculties. Dr. Adebar is Chair of the Council of Senates Budget Committee, a member of the Senate Academic Policy Committee, the Student Appeals on Academic Discipline Committee and an (elected) member of the Senate Nominating Committee. Professor Adebar has served on four previous presidential advisory committees for the search of senior administrators at UBC including: (i) Provost and VP Academic, (ii) Dean of the Faculty of Applied Science, (iii) Vice-Provost and AVP Enrolment and Academic Facilities, and (iv) Senior Advisor to the Provost on Women Faculty.

NB: The Nominating Committee advises Senate that Dr Adebar recused himself from committee deliberations regarding this recommendation. The Committee is aware of concerns regarding recommending of one its own members to a search committee; however, given that Dr Adebar was not involved in this recommendation, and there is no prohibition in the Rules and Procedures of Senate nor in Policy 18 regarding a member of the Nominating Committee being recommended, the Committee is of the opinion that it would be inappropriate to exclude Dr Adebar from consideration as he is a faculty member of UBC.

Professor Sian Echard has been at UBC for 26 years. She is currently Head of English and served for almost five years as the first SSHRC Coordinator in the VPRI. She has participated on every level of tenure and promotion committees, including 4 years on DAC in Arts, and 2 years on SAC. Outside the university, she has been President of one of her disciplinary associations; is on the editorial board of several journals; and for the last 3 years, has the SSHRC Insight Grant Literature adjudication committee. Dr Echard holds Killam prizes for both research and teaching, and was named a Distinguished University Scholar in 2004.

Professor Janice Eng has long history with UBC as an alumni, as a faculty member for 20 years, and more recently as a parent of a current UBC undergraduate student. She is a Senior Canada Research Chair and who investigates ways to maximize the rehabilitation and recovery in people living with neurological health conditions. She is also the Director of the Rehabilitation Research Program, Vancouver Coastal Health Research Institute which includes 9 faculty and a dynamic training program for over 40 trainees. Dr Eng previously served as the Health Research Advisor for the VP Research and International (for 7 years), Interim Head for the Department of Physical Therapy, and is currently Associate Dean in the Faculty of Graduate and Postdoctoral Studies.

Professor John Innes is Dean of the Faculty of Forestry at UBC. He was appointed FRBC Chair of Forest Management in the Faculty of Forestry in July 1999, having previously worked as a Section Leader in the Swiss Federal Institute for Forest, Snow and Landscape Research in Birmensdorf, Switzerland. Dr. Innes sat on the Search Committee for the current Dean of Land and Food Systems, and has chaired several searches for Department Heads in the Faculty of Forestry. He has served in several external roles, including being Chair of the Commonwealth Forestry Association, Vice President of the
International Union of Forest Research Organizations, Chair of FORREX, and Chair of the Standing Committee on Commonwealth Forestry. His research covers various aspects of global change, particularly as they relate to forests, and has recently been focused on China and southeast Asia. Dr. Innes is a past recipient of the Scientific Achievement Award from the International Union of Forest Research Organizations and the International Forestry Award from the Canadian Institute of Forestry. He currently teaches an undergraduate course in international forestry and has in the past taught courses in forest management and tropical forest ecology. He has numerous publications, including a textbook in sustainable forest management published in November this year.

B) Appointments to the President’s Advisory Committee for the Selection of a Vice-President Research & International

The Committee has received a request from President Ono to appoint two persons to an advisory committee being formed pursuant to Joint Board-Senate Policy 18. Since that time, the Committee notes that the President has expressed a desire to separate out UBC’s international initiatives from the vice-president's portfolio. Although Schedule 1 of Policy 18 has yet to be changed to formal modify the position being filled, the Senate Nominating Committee has proceeded to consider candidates focusing on the research aspects of the portfolio. Under Policy 18, the Senate must appoint two persons to the search committee; one of those persons must be a faculty member, and the other must be a faculty member or a students. The Committee notes that under that policy additional members are appointed by the Board of Governors, appointed by the Okanagan Senate and elected by the students. In addition to those names developed by the Committee, in response to a call for additional nominations made to all faculty members and students of UBC, an additional five faculty members and two students put their names forward for consideration. Personal statements were sought from all nominees, including those developed by the committee. A list of all those nominated as well as their statements are available from the Committee’s secretary.

In considering recommendations to Senate, the Senate Nominating Committee considered its traditional criteria in making recommendations. These are:

- Past and current service experiences and background, including but not limited to search/hiring committee experience
- Familiarity with UBC, the position in question, academic research, and post-secondary educational administration
- Discipline and demographic balance

The Committee has considered possible appointees, and is pleased to recommend:

*That Dr Matthew Evenden and Dr Jean Shoveller be appointed to the President’s Advisory Committee for the Selection of a Vice-President Research & International.*
Professor Matthew Evenden is a Professor of Geography and an Associate Dean (Research and Graduate Studies) in the Faculty of Arts. A specialist in environmental history and historical geography, Evenden’s research examines how human communities perceive, develop and contest rivers and waters. His latest book is *Allied Power: Mobilizing Hydro-electricity during Canada’s Second World War* (University of Toronto Press, 2015), which examines how the power needs of wartime production drove hydro development across Canada. Before entering the dean’s office, Evenden served as chair of Canadian Studies at UBC (2011-2015). He was also a founding executive member (2005-2015) of the Network in Canadian History and Environment/ Nouvelle initiative canadienne en histoire de l’environnement (NICHE) and co-director (2007-2015) with Stéphane Castonguay of the Canadian Water History Project/Projet sur l’histoire de l’eau au Canada. In 2008, he was appointed as an early career scholar of the Peter Wall Institute of Advanced Studies. In 2011 he received a UBC Killam teaching prize.

Jeannie Shoveller, PhD, is a Professor at the UBC School of Population & Public Health and the Director of Epidemiology & Population Health and the Drug Treatment Program at the BC Centre for Excellence in HIV/AIDS. Professor Shoveller’s research focuses on social health inequities experienced by young people, with a particular emphasis on gender, sexual and reproductive health. Since taking up her initial appointment at UBC in 1999, she has served as Principal Investigator on more than 20 studies and has published 110+ peer-reviewed manuscripts. Prof. Shoveller has supervised the training of 50+ Doctoral and Master’s students as well as Post-Doctoral Fellows. All of her students and fellows have been awarded prestigious fellowships to support their training (e.g., CIHR; Fulbright; Vanier; Banting; Killam; Trudeau; MSFHR). Dr Shoveller was an active member of the Institute Advisory Board for CIHR’s Institute of Population and Public Health (2005-2013) and as a former Co-Chair of the Population Health Intervention Research Initiative for Canada (a Pan-Canadian network of 15 government agencies, research funders, NGOs, and health charities).

**C) Adjustments to Committee Assignments**

The Senate Nominating Committee recommends the following adjustments to the memberships of Senate Committees:

*That Dr Christian Naus be appointed to the Senate Agenda Committee until 31 August 2017 and thereafter until replaced, to replace Dr Sally Thorne;*

*That Acting Dean Kathryn Harrison be appointed to the Senate Ad Hoc Committee on Flexible Learning until 31 August 2017, to fill a vacancy;*

*That Mr Jeff Solis be appointed to the Senate Curriculum Committee until 31 March 2017 and thereafter until replaced, to replace Ms Jolene Loveday; and*

*That Mr Jeff Solis be appointed to the Senate Library Committee until 31 March 2017 and thereafter until replaced, to replace Ms Jolene Loveday.*