AGENDA OF THE OPEN SESSION
OF THE MEETING OF SENATE

Held on Friday, October 16, 2020, at 2 p.m.,
via Zoom Video Conferencing

Join Zoom Meeting: https://concordia-ca.zoom.us/j/92591397110
Meeting ID: 925 9139 7110
Passcode: 376861
Join by conference call: 1-438-809-7799 Canada

Item		Presenter/s	Action
1.	Call to order	G. Carr	
1.1	Adoption of the Agenda	G. Carr	Approval
1.2	Adoption of September 18, 2020 Minutes	G. Carr	Approval
2.	Business arising from the Minutes not included on the Agenda	G. Carr	
3.	President's remarks	G. Carr	Information
4.	Academic update (Document US-2020-5-D1)	A. Whitelaw	Information
CONSENT AGENDA		G. Carr	
5.	Committee appointments (Document US-2020-5-D2)		Approval
6.	Academic Programs Committee – Report and recommendations (Document US-2020-5-D3)		Approval
6.1	Undergraduate curriculum proposals – Faculty of Arts and Science		
6.1.1	Department of Applied Human Sciences (Document US-2020-5-D4)		
6.1.2	Department of Mathematics and Statistics (Document US-2020-5-D5)		

6.1.3	Department of Physics (Document US-2020-5-D6)		
6.1.4	Department of Psychology (Document US-2020-5-D7)		
6.2	Undergraduate curriculum proposals – Gina Cody School of Engineering and Computer Science		
6.2.1	Department of Electrical and Computer Science (Document US-2020-5-D8)		
6.2.2	Department of Mechanical, Industrial and Aerospace Engineering (Document US-2020-5-D9)		
6.3	Graduate curriculum proposal – Gina Cody School of Engineering and Computer Science – Department of Chemical and Materials Engineering (Document US-2020-5-D10)		
7.	Registrar's report on Spring 2020 and Fall 2019 graduation statistics (Document US-2020-5-D11)		Information

REGULAR AGENDA

8.	Academic Planning and Priorities Committee - Report on internship study at Concordia (Document US-2020-5-D12)	A. Whitelaw/ N. Bhuiyan	Information
9.	Question period *(maximum - 15 minutes)*		
10.	Other business		
11.	Adjournment	G. Carr	

US-2020-4

MINUTES OF THE OPEN SESSION OF THE MEETING OF SENATE

Held on Friday, September 18, 2020
immediately following the Closed Session
via Zoom Video Conferencing

PRESENT

Voting members: Graham Carr *(Chair)*; Adewunmi Ajike; Ali Akgunduz; Nicholas Bailey; Leslie Barker; Elizabeth Bloodgood; Catherine Bolton; Sally Cooke; Frank Crooks; Anne-Marie Croteau; Selvadurai Dayanandan; Alex De Visscher; Mourad Debbabi; Effrosyni Diamantoudi; Linda Dyer; Mary Esteve; Medhi Farashahi; Ariela Freedman; Annie Gérin; Vince Graziano; Fiona Harrison-Roberts; Safwan Hye; Hannah Jamet-Lange; Samantha Leger; Colin Long; Sarah Mazhero; Christopher Moore; Catherine Mulligan; Virginia Penhune; Gilles Peslherbe; Pascale Sicotte; Reza Soleymani; Robert Soroka; Ron Stern; Alexander Stojda; Kelly Thompson; Guylaine Vaillancourt; Anne Whitelaw; Paula Wood-Adams; Radu Zmeureanu

Non-voting members: Joanne Beaudoin; Philippe Beauregard; Paul Chesser; Roger Côté; Denis Cossette; Stéphanie de Celles; Isabel Dunnigan; Nadia Hardy; Tom Hughes; Candace Jacobs; Frederica Jacobs

ABSENT

Voting members: Shimon Amir; Matthew Barker; Guylaine Beaudry; Christopher Brett; James Hanna; Helena Osana; Jean-Philippe Warren; Natalia Whiteley

1. Call to order

The meeting was called to order at 2:12 p.m.

1.1 Adoption of the Agenda

R-2020-4-4 *Upon motion duly moved and seconded, it was unanimously resolved that the Agenda of the Open Session be approved.*

1.2 Adoption of May 22, 2020 Minutes

R-2020-4-5 *Upon motion duly moved and seconded, it was unanimously resolved that the Minutes of the Open Session meeting of May 22, 2020.*

2. Business arising from the Minutes not included on the Agenda

There was no business arising from the Minutes not included on the Agenda.

3. President's remarks

Dr. Carr welcomed Senators, including new Deans Gérin and Sicotte.

He underlined some notable events:

- the opening of the new Applied Science Incubator on the Loyola Campus;
- the launch on September 10 of the Jonathan Wener Centre for Real Estate;
- today is the kickoff of the week-long Shuffle 31, the annual walkathon to raise funds for student scholarships and bursaries;
- the receipt of $1.6 million from the federal Canadian Research Continuity Emergency Fund to support research personnel who were affected in the first 12 weeks of the COVID-19 pandemic;
- the final touches are being brought to the mandate and action plan of the Task Force on Black Lives Matter.

Dr. Carr reported the sad news that Charles (Chuck) Bertrand died last week. Dr. Bertrand had served the University is a number of roles, including interim President in 1994. He was a beloved colleague and member of the community.

He also conveyed the bittersweet news that today was Roger Côté's last Senate meeting. The latter is retiring after 39 years in a number of roles. Dr. Carr expressed his deep appreciation for Mr. Côté's stellar work. He announced that effective October 1, Michael Di Grappa has been appointed Vice-President, Services and Sustainability.

Dr. Carr welcomed the government's decision to create the Ministère de l'Enseignement supérieur (MES) as a separate ministry, headed by Minister Danielle McCann and a seasoned Deputy Minister, Bernard Matte.

He informed the Board that Summer enrolment was 15% higher than last year with the lowest drop-out rate. Incredibly, Co-op placed 721 stages versus 504 last Summer, the overwhelming majority were for work-study done online. With respect to Fall enrolment, at this point the headcount is roughly on par with last Fall. However, there is slippage at the Professional Master's Degree level which will affect tuition revenue that cannot necessarily be made up by undergraduate and PhD enrolments. We will have a clearer picture once the DNE date will have passed.

The President spoke of the huge challenges facing faculty and staff and the colossal efforts to prepare remote delivery for the Fall term in the environment of telework, including the relentless pace of the online environment. He also spoke of the

management of the return to campus of some activities, including the reopening of 200 research labs, faculty offices and the libraries, on a restricted basis, while noting that the Fall varsity sports season has been cancelled.

All decisions are driven by the health of the Concordia community but also the urban community. While the decision about the Winter term will be made in the coming weeks, in concert with other Montreal universities, unions have been advised to inform their personnel to prepare for an online Winter term.

4. Academic update (Document US-2020-4-D2)

This document is provided for information.

CONSENT

5. Committee appointments (Document US-2020-4-D3)

R-2020-4-6 That the committee appointments be approved.

REGULAR

6. Annual report from the Ombuds Office (Document US-2020-4-D4)

Ombudsperson Amy Fish presented the highlights of the annual report, including some key statistics. To illustrate the type of concerns and issues the Ombuds Office deals with on a regular basis, Ms. Fish provided three examples. She was pleased to inform the Board that she had encountered no major problems throughout the year and underlined the University's commitment to openness and fairness.

7. Annual report from the Office of Rights and Responsibilities (Document US-2020-4-D5)

Director and Senior Advisor Lisa White summarized the mandate of the Office of Rights and Responsibilities (ORR) and presented the highlights of the annual report, including some key statistics. To illustrate the type of situations that ORR deals with on a regular basis, Ms. White shared three narratives.

8. Annual report of the academic hearing panel (Document US-2020-4-D6)

Melodie Sullivan, Senior Legal Counsel, explained the process that leads to a hearing and presented the highlights of the report, which is provided annually for information purposes in accordance with the requirements set out in Article 94 of the *Academic Code of Conduct* and responded to questions.

9. Question period

Prof. Freedman queried about the ventilation of space on campus and expressed a concern about the pace of working from home for those who are caregivers. Dr. Carr acknowledged that there is a disproportionate impact on different categories of individuals because of their responsibilities. For that reason, faculty members are encouraged to record their classes. The gradual reopening of library spaces can provide some space as an alternative to the home environment. HR is trying to better support staff and faculty to facilitate work from home and is looking into different initiatives, including encouraging Zoom-free Fridays.

With respect to outdoor spaces, Dr. Carr said that the University is not yet looking at next Spring or Summer. So far, few students have taken up the opportunity to be on campus. Mr. Côté noted that access remains limited for now.

Responding to Ms. Mazhero's concern that some faculty are not recording their class content, Dr. Whitelaw said that the importance of recording class content has been emphasized to all faculty members, the majority of whom are doing so. She suggested that students with concerns that lectures are not being recorded bring this up with their professor.

Mr. Joyner asked if it would be under Senate's purview to consider the future of remote learning. Dr. Carr made the point that Concordia will never become fully online but that some opportunities could be beneficial. As is currently the case, with regard to new courses or programs — as opposed to new online sections of existing courses -- this discussion would first occur at the department or unit level where curriculum and program development is initiated prior to going to Faculty Councils and the Academic Programs Committee (APC). Dr. Whitelaw added that a sustained conversation on teaching and learning has come out of the last few months. A working group was established in the Spring to address and adapt to the immediate challenges. She is considering keeping this as a permanent committee to maintain and engage the discussion.

10. Other business

There was no other business to bring before the meeting.

11. Adjournment

The meeting adjourned at 3:26 p.m.

D. Tessier

Danielle Tessier
Secretary of Senate

US-2020-5-D1

Internal Memorandum

To: Members of Senate
From: Anne Whitelaw, Interim Provost and Vice-President, Academic
Date: October 6, 2020
Re: Academic Update

We are halfway through the semester and I want to thank everyone for their diligence ensuring a smooth beginning of term. As I write, universities are being asked to put in place their emergency protocols in anticipation of a red alert phase in the current crisis; I am pleased to say that Concordia was well-prepared and positioned to implement the relatively few additional measures required, and that we have continued the term with few disruptions to our academic activities. I want to thank everyone for all their hard work throughout the summer to ensure our preparedness for a mostly online term in the Fall, and for the work that continues to happen to prepare for the winter. It has not been easy or simple, but we have done what needed to be done so that our students receive the great education for which we are known.

Every October, Concordia welcomes 5,000 prospective students and their families to the fall Open House. This year's event is happening virtually for the first time. The virtual Open House is taking place on two different days: Saturday, October 24 from 9 a.m. to 1 p.m. for prospective undergraduates and Saturday, November 7 from 9 a.m. to 1 p.m. for prospective graduate students. Registration is free and can be done through the Open House webpage.

Visitors will find all the information available at a traditional in-person Open House, ranging from how to apply to specific programs and details about what to expect from student life, to resources for funding your education and support for international students. Visitors will be able to catch scheduled presentations from faculty recruiters and chat in real-time with Concordia professors and students at virtual information booths. Live-chat booths will be covering questions about residences, off-campus housing, not to mention finding a job on campus, joining clubs and playing sports. International students can find out about how to assemble their required documentation to join the Concordia community in Montreal.

On November 7, the graduate studies Open House will also be the place to find information on applying for research funding, opportunities to work as a teaching assistant and research assistant and much more about the many graduate programs at Concordia.

On September 3, Grad Orientation welcomed over 750 new graduate students from all around the world. Held virtually for the first time, our community was showcased through 35 booths, and engaged in over 3,282 unique student visits. Students downloaded nearly 3,000 documents, and over 900 videos were watched, covering all aspects of the graduate experience and the teams that support them. This extraordinary event was the result of university-wide collaboration and overall commitment to our students.

In April, CU at Home was launched to the Concordia community. This university-wide initiative aims to increase connection and provide support to students, alumni, faculty, staff and partners, and their families during the COVID-19 pandemic. Over the last six months, the project's digital presence evolved alongside the growing number of participating units. The CU at Home web landing page – which had 11,711 total page views and 8,652 unique views from April to August – was updated with a new web structure to better classify programming. During that same period, social media saw an average engagement rate of 1.25 (benchmark is between 1 - 1.5) and generated close to 300K impressions. Looking ahead, CU at Home will focus on promoting wellness and interactive virtual activities that feel as in-person as possible. Programming may include regular drop-in events or hangouts related to cooking, languages, sports, books, movies, mindfulness and more – even time-zone-specific programming for those living outside of Montreal or Canada.

Since the campus's closure on March 13, the Library team has been working tirelessly to offer enhanced remote access and, when feasible, on-site access to library space and material. Since that date, over 5,600 reference questions have been answered by email, live chat, and video (Zoom), over 2,600 items have been borrowed using the Contactless Book Pick Up Service, approximately 800 articles/book chapters have been sent by email using the Scan & Deliver Service, and over 10,000 items are currently available to students via electronic course reserves. On September 14, both Webster and Vanier Libraries have made a limited number of individual study spaces available by reservation. In the first two weeks, 326 bookings were made by Concordia students.

Concordians now have access to 4,000 online courses through the Udemy platform. Faculty, staff and students are invited to boost their professional skills, with an emphasis on digital capabilities. The on-demand learning platform offers a vast selection of non-academic courses ranging from IT operations and web development, to leadership and marketing, and project management and operations. Concordia community members will benefit from the Udemy platform's high-quality professional course content, access to online courses anytime, anywhere and curated learning resources that can be combined to build customized learning paths. It's a much-needed substitution for in-person workshops, given the current public health crisis.

With a growing need to facilitate remote access to research and University initiatives, 4TH SPACE is using its online platforms and social media channels to connect audiences to academic activities that complement weekly live event production. To that end, a number of video series were produced and released in September, for example: 2020 CURC recipients were interviewed with 2-minute soundbites released as a "Meet the CURCs" video series, soon to be complemented with longer-format podcasts; Researchers with lab or studio access are being invited to provide in-depth demonstrations of their projects via a "Lab Walk Through" series; and the weekly #FridayReads series features students, staff, and researchers recommending recent publications. Virtual and hybrid (with some activities in situ) residencies continue to flourish as a model for engagement, most recently with Vivek Venkatesh's "Landscape of Hope" project activating 4TH SPACE.

Key back-to-school events at 4TH SPACE focused on: Summer 2020 classroom outcomes, new research mandates, and innovative action. In terms of pedagogy, workshops related to two co-taught Wicked Problems courses on "Social Innovation through Creative Knowing" and "Wastescapes" were developed to make classroom outcomes accessible. Research and the work of faculty members was highlighted through a 2-part roundtable conversation with new Concordia University Research Chairs and an event focused on academic leadership to welcome FAS Dean, Pascale Sicotte to our community. Finally, innovative actions across the University were highlighted through a celebration of the Spark! Campaign,

a Face Mask Prototype Challenge showcase, and community-focused workshops stemming from the newest Maker Culture and Healing research.

Every summer, between their first and second academic year, master's students in Concordia's Department of Studio Arts are required to complete a three-credit course called Directed Studio Practice (DISP 615) to expose MFA candidates to alternative modes of making art and allow them to delve deeper into their research and keep working in their studios over the summer. Although many students were apprehensive about the shift to remote learning at the end of the winter term, they collectively overcame that hesitation in the summer term through virtual platforms. Students met on Zoom for project proposals, feedback sessions, peer-to-peer interviews, final presentations and critiques. After learning about one another's practices in the first week of DISP 615, each student selected a classmate to interview. Over the summer, they spoke with one another about their background, art practice and current summer project. They then shared the interviews with the rest of the class in the final two weeks. The final projects can be found online through the Department of Studio Arts. You can read the profiles of the students in DISP 615 on the MFA artist profiles page.

The Office of Community Engagement (OCE) and the Experiential Learning Office are working on the Anchored Sites project. During the 2020-2021 academic year, the OCE will offer active learning opportunities to undergraduate and graduate Concordia students using both paid work-integrated opportunities (15 internships) with partner community, non-profit organizations and anchored-site research work in Montreal neighbourhoods. This dual strategy will lead to developing new partnerships and strengthening existing ones. The three anchored projects are:

- Considering alternative approaches to supporting survivors of sexual violence in the Montréal Nord neighborhood. This project will occur in collaboration with the Simone de Beauvoir Institute (Marlihan Lopez and Prof. Natalie Batraville) and the community organization Hoodstock
- Considering the impact of the emergent artificial intelligence and technological cluster in the Marconi Alexandra neighborhood on housing and community well-being in nearby sectors. This project will occur in collaboration with Communication Studies professors Alessanra Renzi and Fenwick McKelvey and Prof. Norma Rantisi (Geography).
- Mikana and the Montreal Indigenous Community NETWORK as Indigenous anchored sites - with the aim to create a Montreal-specific educational tool for stakeholders and decision-makers by synthetizing key information regarding Indigenous youth safety, wellbeing, and belonging with a special focus on gender and culturally appropriate interventions.

OCE also brokered a partnership between The Open Door Montreal, a shelter for homeless Montrealers and Concordia's PERFORM Centre – PERFORM will help optimize and integrate food donations into a new rotating and flexible menu for The Open Door Montreal. Finally, the OCE is collaborating with the Sustainability Action Fund at Concordia on a Living Labs initiative that will provide funding support to students interested in leading social and environmental sustainability initiatives out of Bâtiment 7. The deadline for submitting projects is October 20.

Concordia's District 3 Innovation Hub is fast-tracking training for talent to work in multidisciplinary teams with innovative biotech and life sciences startups. This summer, District 3 hosted a four-week intensive program to enable business professionals and engineers to understand the science and language behind biotech — crucial for those who wish to work in this field. The BioLingual Program offered practical multidisciplinary learning opportunities through several interactive live online sessions. Participants

learned how the latest technologies are used to engineer biological solutions and began developing their network by meeting startups and biotech scientists looking for co-founders and team members. The program covered a breadth of topics, including macromolecules, gene expression, enzymes and enzymatic pathways, anatomy and physiology, immunology and the future of translational research in biotech. The four weeks culminated on September 10 with a matchmaking session, with biotech scientists and founders looking to hire new team members from among the graduates.

A first-of-its-kind in Canada, the Jonathan Wener Centre for Real Estate has opened at Concordia University's John Molson School of Business. The centre will be a hub for teaching and research on commercial and residential real estate. The centre's main goals are to:

- Train the next generation of real estate professionals by providing students with the cutting-edge knowledge and real-world experience they need to succeed in the field;
- Drive innovation through knowledge creation and provide real estate leaders with insights into an evolving market and industry;
- Provide industry players and employees with training and tools to adapt and excel.

Finance lecturer Michel Deslauriers has been named director of the Centre.

JMSB20 is the celebration of the 20th anniversary of the renaming of the John Molson School of Business. Concordia University's Faculty of Commerce and Administration became the John Molson School of Business following a generous donation from the Molson family and the Molson Foundation in November 2000. To celebrate this anniversary, the John Molson School of Business will host a series of virtual events, social media campaigns, and a blog, to celebrate what makes the school so unique and special: its community.

On September 28th, a student committee at the PERFORM Centre organized and hosted a virtual half-day workshop titled *Getting off the Ground: Starting a Research Lab in Academia*. Seventy-six students attended the special event where Concordia researchers Habib Benali, Mihaela Iordanova, Alisa Piekny, Linda Booij, Christophe Grova and Maryse Fortin discussed the steps they undertook in starting a research lab and advancing their research programs.

Machine Agencies, an interdisciplinary group of researchers at Milieux Institute for Arts, Culture and Technology exploring social and cultural implications of AI, launched a 4-part speaker series with its inaugural event: Public Controversies and the Future of AI. More than 70 people attended the event featuring leading global scholar Christian Katzenbach.

Between October 13 and October 18, more than 20 Milieux members will present their research at the International Symposium for the Electronic Arts 2020. To document this high-level engagement with one of the world's most prominent events on arts and tech, Milieux collaborated with ISEA to produce a short series showcasing graduate work and live-tweeted events.

Running from September 24 to November 5, an esteemed line-up of Indigenous scholars, artists, and educators on spirituality and Indigeneity are participating in Spirituality as Land, Story and Relation, a four part event series that invites guests from the worlds of poetry, academia, film and literature to engage in discussion around a variety of issues related to spirituality and Indigeneity. The series is presented by the Department of Theological Studies . More information can be found here.

Concordia University Research Chair Ann-Louise Davidson is launching her new children's book, *Amber the Maker*, about one young child amputee's journey to empowerment via makerspaces (and a friendly dragon). The book is an educational resource designed to be used by parents and teachers to discuss makerspaces, bullying, and overcoming obstacles.

Postdoctoral student and SHIFT Steering Committee member Jennifer Gobby released her new book, *More Powerful Together: Conversations with Climate Activists and Indigenous Land Defenders* which explores environmental issues from multiple perspectives. Gobby is a graduate of the department of Geography, Planning and Environment, and all proceeds from her book will be donated to the Indigenous Climate Action Fund.

Debbie Folaron, a specialist in Romani languages and multilingual translation practices in the *Département d'Études Françaises*, has become the first-ever Concordia professor to be awarded a rare Jean Monnet Chair by the European Union. The 3-year post is designed to promote excellence in teaching and research in the field of European Union studies worldwide.

In his new book, André Gagné, professor in Concordia's Department of Theological Studies, focuses on how the ideas and biblical interpretations of ultraconservative Christian groups determine their political beliefs and engagement. *Ces évangéliques derrière Trump*, published this month by Labor et Fides, details the theological worldview that undergirds much of the Christian right's support for United States President Donald Trump.

Quebec filmmaker Pascal Plante (BFA film prod., 11) became the toast of the Canadian film industry when his critically-acclaimed feature film *Nadia, Butterfly* was named one of the 56 films in the 2020 Official Selection of the Cannes Film Festival. The film was shot in 2019 in Montreal and Tokyo, and offers an insider's view of the end of an Olympic career and the search for identity beyond the pool.

Zachary Patterson (Geography, Planning and Environment) is collaborating with Polytechnique Montréal on a MITACS project entitled "Micro Transit Demand Management (microTDM) with Big Data and Artificial Intelligence". Supported by BusPas Inc., an affiliate of ISR Transit, the project will fund a total of 153 internship units. The goal is to understand how to incentivize changes in transit user behavior that can reduce the need for unnecessary operational costs while not diminishing transit user experience.

Vincent Martin (Biology) has received a further investment from the National Research Council of Canada towards the Genome Foundry for the "Development of an automated high throughput platform for genome engineering of mammalian cells". The funding will continue to solidify the Concordia Centre for Applied Synthetic Biology's role as the go-to place for iterative rounds of genome engineering in intended engineered cells.

Catharine Marsden (Professor Emeritus, Centre for Engineering in Society) will be collaborating with Cascade Aerospace Inc. and Marinvent Corporation on a NSERC CRD entitled "Requirements Management for Aerospace Modification and Missionizing." The project aims to develop tools and processes to support organization, procedural and product innovation in the aerospace Maintenance, Repair and Overhaul (MRO) sector.

Simon Bacon (Health, Kinesiology and Applied Physiology) received $200,000 through the CIHR Operating Grant: COVID-19 Mental Health & Substance Use Service Needs and Delivery competition for his project, "A behavioural science approach to evaluate the prevalence and predictors of COVID-19-

related mental health issues and maladaptive behavioural coping (MBC) to inform the development of strategies for tailored interventions."

Kathleen Kennedy-Turner, a PhD graduate from the Department of Psychology, has been awarded the *Prix Relève étoile Paul Gérin-Lajoie* for September by FRQSC. Kennedy-Turner was recognized for her article "Prevention of Criminal Offending: The Intervening and Protective Effects of Education for Aggressive Youth," which was published in *The British Journal of Criminology*.

Public Scholar Erika Pimentel was Concordia's Newsmaker of the Month for August. A CPA and a doctoral candidate at JMSB specializing in Accounting, she explores how professionals create meaning through their work. Appearing in The Conversation and The Montreal Gazette, as well as featured in numerous radio interviews across Canada, her research is exceptionally timely as we re-evaluate the notion of work during a lengthy pandemic.

UNIVERSITÉ Concordia UNIVERSITY

COMMITTEE APPOINTMENTS

Committee	Appointee	Term
Academic Planning and Priorities	Andre Furlani (A&S)	2020/2023
Academic Programs	Eldad Tsabary (FA)	2020/2023
Library	Mohsen Farhadloo (JMSB)	2020/2023

Appointments requiring Senate ratification	Appointee	Term
Faculty Tribunal Pool	Kevin Gould (SGS)	2020/2022
	Martin Lefebvre (SGS)	2020/2022
	Xavier Ottenwaelder (SGS)	2020/2022
	Marlene Sokolon (SGS)	2020/2022
Student Tribunal Pool	Nicholas Bailey (CSU)	2020/2022
	Meryem Benallal (CSU)	2020/2022
	Sam Crooker (CSU)	2020/2022
	Colin Long (CSU)	2020/2022
	Shoshana Nigri (CSU)	2020/2022
	Phoebe Tom (CSU)	2020/2022
	Shaina Willison (CSU)	2020/2022

October 9, 2020

US-2020-5-D3

ACADEMIC PROGRAMS COMMITTEE
REPORT TO SENATE
Sandra Gabriele, PhD
October 16, 2020

The Academic Programs Committee requests that Senate consider the following undergraduate changes for the 2021-22 Undergraduate Calendar:

Following approval of Faculty Councils, on September 22, 2020, APC members reviewed the undergraduate curriculum submissions from the Faculty of Arts and Science and the Gina Cody School of Engineering and Computer Science. As a result of discussions, APC resolved that the following undergraduate curriculum proposals be forwarded to Senate for approval:

Faculty of Arts and Science

Department of Applied Human Sciences
US-2020-5-D4 (For January 2021 Implementation)
[The proposal involves the addition of a 24-credit prerequisite to course AHSC 381.]

- Courses

Department of Mathematics and Statistics
US-2020-5-D5 (For May 2021 Implementation)
[The proposal involves the change of the program from 'Joint Major in Mathematics and Statistics and Computer Applications' to 'Joint Major in Mathematics and Statistics and Computer Science further to a decision made by the Gina Cody School of Engineering and Computer Science to discontinue it Computer Applications Option.]

- Program name change

Department of Physics
US-2020-5-D6 (For May 2021 Implementation)
[The proposal involves the addition of two new research experiences courses for students enrolled in the Honours program, the removal of obsolete courses, and changes to the titles and descriptions of courses to reflect their updated content.]

- Courses
- Requirements

Department of Psychology
US-2020-5-D7 (For September 2021 Implementation)
[The proposal involves an increase in the GPA requirement for the Honours program from a threshold of 3.5 to 3.7, and an increase in the GPA requirement for the Specialization program from a threshold of 3.0 to 3.2.]

- Requirements

Gina Cody School of Engineering and Computer Science
Department of Electrical and Computer Engineering
US-2020-5-D8 (For May 2021 Implementation)
[The proposal involves the removal of all Options from the BEng in Electrical Engineering and the removal of all Options from the BEng in Computer Engineering, except for the Pervasive Computing Option and the Biological and Biomedical Option.

- Courses
- Requirements

Department of Mechanical, Industrial and Aerospace Engineering
US-2020-5-D9 (For May 2021 Implementation)
[The proposal involves the separation of the lab component from MIAE 311, the removal of the lab from MECH 447 and ELEC 442; the addition of a lab component to COEN 243, updates to course descriptions and notes for several courses; revisions to the program requirements for Mechanical, Industrial and Aerospace Engineering programs, revisions to the Basic and Natural Sciences course list; and the division of the Industrial Engineering electives list into two categories.]

- Courses
- Requirements

The Academic Programs Committee requests that Senate consider the following graduate changes for the Summer 2021 Graduate Calendar:

Following approval of Faculty Councils and the Graduate Curriculum Committee, on September 22, 2020, APC members reviewed the graduate curriculum submission from the Gina Cody School of Engineering and Computer Science. As a result of discussions, APC resolved that the following graduate curriculum proposal be forwarded to Senate for approval:

Gina Cody School of Engineering and Computer Science
US-2020-5-D10 (For January 2021 Implementation)
[The proposal involves the addition of a new required course CHME 6981 Chemical Engineering Research Protocols and Safety to the PhD and MASc programs in Chemical Engineering, as well as minor changes to the structure of the programs. Course descriptions have been added to ENGR 8901 and ENGR 8911.]

Sandra Gabriele, PhD
Vice-Provost, Innovation in Teaching and Learning September 29, 2020

UNIVERSITÉ Concordia UNIVERSITY

INTERNAL MEMORANDUM

TO: Dr Sandra Gabriele, Vice-Provost, Innovation in Teaching and Learning
Office of the Provost and Vice-President, Academic Affairs
Chair, Academic Programs Committee

FROM: Dr André Roy, Dean, Faculty of Arts and Science
Chair, Arts and Science Faculty Council

DATE: June 2, 2020

SUBJECT: 2021-22 Undergraduate Calendar Curriculum Changes
Department of Applied Human Sciences
AHSC-36
Prerequisite change to AHSC 381

The following proposal was reviewed and approved at the Arts and Science Faculty Council meeting of May 15, 2020. We request that this proposal be considered at the next meeting of APC.

In an effort to ensure that students are adequately prepared, the **Department of Applied Human Sciences** is adding a 24-credit prerequisite requirement to take AHSC 381 *Concepts in Therapeutic Recreation Programming.* This course currently lists the prerequisites AHSC 241 *Recreation and Leisure in Contemporary Society,* AHSC 260 *Program Planning, Design and Evaluation* and AHSC 281 *Introduction to Therapeutic Recreation,* totalling nine credits. In adding 15 University prerequisite credits to the existing nine, the department is ensuring that the students are more advanced in their studies and have a better academic base before progressing to this course which focuses on more advanced leisure planning and assessment models and explores practices in rehabilitation in community and clinical settings.

Thank you for your consideration of this proposal for which there are no additional resource implications.

Reference documents:
FCC 2019.5_AHSC-36
ASFC-2020-4M-B

Department of Applied Human Sciences

AHSC-36

Memo from Chair

Prerequisite Change

AHSC 381 *Concepts in Therapeutic Recreation Programming*

Concordia University
Arts and Science
Department of Applied Human Sciences

INTERNAL MEMORANDUM

TO: Richard Courtemanche, Associate-Dean, Academic Programs

FROM: Peter Morden, Chair, Department of Applied Human Sciences

DATE: February 18, 2020

SUBJECT: **Curriculum Proposal**

Following the unanimous approval by the Full-time Faculty Committee at its meeting on February 6, 2020, the Department of Applied Human Sciences is proposing the following undergraduate program change for your consideration:

1. *AHSC 381: Concepts in Therapeutic Recreation Programming*
   Prerequisites: AHSC 241, 260 and 281

Change to:

2. *AHSC 381: Concepts in Therapeutic Recreation Programming*
   Prerequisites: 24 university credits including AHSC 241, 260 and 281

AHSC 381 includes a field component where students are required to effectively assess, develop, implement, and evaluate Therapeutic Recreation (TR) interventions for populations with cognitive and/or physical disabilities. With the current prerequisites, students may take AHSC 381 in their first year within the Therapeutic Recreation specialization, without having gained significant exposure to the field to inform programming for diverse populations.

Requiring the completion of 24 university credits including the current prerequisites will allow students to gain more exposure to, and knowledge of, core issues impacting such populations prior to applying TR programming concepts.

This proposal will allow the students for a better competency-based preparation to undertake the field component of TR interventions and programming for populations with cognitive and/or physical disabilities.

This proposal has no resource implications.

I would be pleased to respond to any questions you may have about this proposal.

Peter Morden
Chair, Department of Applied Human Sciences
L-VE- 223.02

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **AHSC-36** VERSION: 3

COURSE CHANGE: AHSC 381 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: January 2021

Faculty/School: Arts and Science
Department: Applied Human Sciences
Program: Specialization Therapeutic Recreation
Degree: BA
Calendar Section/Graduate Page Number: 31.010

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[X] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
AHSC 381 ***Concepts in Therapeutic Recreation Programming*** (3 credits) Prerequisite: AHSC 241, 260, 281. This course explores current therapeutic recreation practices with emphasis on rehabilitation in community and clinical settings such as hospitals, group homes, psychiatric centres, rehabilitation clinics, and correctional centres. Leisure planning and assessment models are studied to identify the modes of recreational activity which may be used as an intervention.	**AHSC 381** ***Concepts in Therapeutic Recreation Programming*** (3 credits) Prerequisite: 24 university credits including AHSC 241, 260, and 281. This course explores current therapeutic recreation practices with emphasis on rehabilitation in community and clinical settings such as hospitals, group homes, psychiatric centres, rehabilitation clinics, and correctional centres. Leisure planning and assessment models are studied to identify the modes of recreational activity which may be used as an intervention.

Rationale:
AHSC 381 includes a field component where students are required to effectively assess, develop, implement, and evaluate Therapeutic Recreation (TR) interventions for populations with cognitive and/or physical disabilities. With the current prerequisites, students may take AHSC 381 in their first year within the Therapeutic Recreation specialization, without having gained appropriate foundational knowledge on working with such populations.

Requiring the completion of 24 university credits including the current prerequisites will allow students to gain more exposure to, and knowledge of, core issues impacting such populations prior to applying TR programming concepts.

Resource Implications:
None

Other Programs within which course is listed:

None

UNIVERSITÉ Concordia UNIVERSITY

INTERNAL MEMORANDUM

TO: Dr Sandra Gabriele, Vice-Provost, Innovation in Teaching and Learning
Office of the Provost and Vice-President, Academic Affairs
Chair, Academic Programs Committee

FROM: Dr André Roy, Dean, Faculty of Arts and Science
Chair, Arts and Science Faculty Council

DATE: June 2, 2020

SUBJECT: 2021-22 Undergraduate Calendar Curriculum Changes
Department of Mathematics and Statistics
MATH-31
BA or BSc Joint Major in Mathematics and Statistics and Computer Science

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The following proposal was reviewed and approved at the Arts and Science Faculty Council meeting of May 15, 2020. We request that this proposal be considered at the next meeting of APC.

The **Department of Mathematics and Statistics** is renaming the *Joint Major in Mathematics and Statistics and Computer Applications Program* to *Joint Major in Mathematics and Statistics and Computer Science* further to a decision taken by the Gina Cody School of Engineering and Computer Science to discontinue its Computer Applications option (proposed under the curriculum proposal COMP-101).

Thank you for your consideration of this proposal for which there are no additional resource implications.

Reference documents:
FCC 2019.5_MATH-31
ASFC-2020-4M-C

Department of Mathematics and Statistics

MATH-31

Memo from Chair

Program change

BA or BSc Joint Major in Mathematics and Statistics and Computer Science

Concordia University
Arts and Science

INTERNAL MEMORANDUM

TO: Dr. Richard Courtemanche, Associate Dean, Academic Programs

FROM: Dr. Cody Hyndman, Chair, Department of Mathematics and Statistics

DATE: 11 February 2020

SUBJECT: **Revision to Joint Major in Mathematics & Statistics and Computer Applications Program**

The Joint Major in Mathematics & Statistics and Computer Applications Program is listed in the undergraduate calendar in two places: section 31.200 (Faculty of Arts and Science) and section 71.85 (Gina Cody School of Engineering and Computer Science) because it is a program that can be taken by students registered in either Faculty.

The Department of Computer Science and Software engineering has recently decided to discontinue the various options in its undergraduate program. Since the Computer Applications option is specifically named in our section of the calendar, our Department is proposing to make the required editorial changes so that our calendar entry is consistent with the revisions made to the entries in section 71.85.

These changes were approved by the Department Curriculum Committee on 20 January and by Department Council on 10 February 2020.

Sincerely,

Cody Hyndman
Chair

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MATH-31** VERSION: 2

PROGRAM CHANGE: 2020-2021 Joint Major in Mathematics and Statistics and Computer Science

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Mathematics and Statistics
Program: Joint Major in Mathematics and Statistics and Computer Science
Degree: BA, BSc
Calendar Section/Graduate Page Number: 31.200

Type of Change:
[X] Editorial [ ] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar	**Proposed Text**
78 BA or BSc Joint Major in Mathematics and Statistics and Computer ~~Applications~~ *Mathematics and Statistics Component* 42.5 COMP 248[3.5]; MAST 217[3] or COMP 232[3]; MAST 218[3], 219[3], 221[3] or COMP 233[3]; MAST 232[3], 234[3], 235[3], 324[3], 331[3], 332[3] or COMP 367[3]; MAST 333[3]*, 334[3] or COMP 361[3]; MATH 339[3] *Computer Science Component* *(see §71.85)* 32.5 COMP 228[3], 249[3.5], 335[3], 346[4], 348[3], 352[3], 354[4], 465[3]; ENCS 282[3], 393[3] 3 Chosen from COMP courses with numbers 325 or higher; SOEN 287[3], 321[3], 387[3], 422[4], 423[4], 487[4] *NOTE: The Faculty of Arts and Science and the Faculty of Engineering and Computer Science have created a program of study which combines a comprehensive education in computer science and mathematics. This program resides in both Faculties. In the Faculty of Engineering and Computer Science, it is offered under the aegis of the Bachelor of/ Baccalaureate in Computer Science~~, Computer Applications Option~~. According to their preferences and aspirations, students may apply either for a Bachelor of/Baccalaureate in Science program, or Bachelor of/Baccalaureate in Arts program or a Bachelor of/ Baccalaureate in Computer Science program. The Computer Science program is described in §71.85.* **NOTE: Students enrolled in a Mathematics and Statistics program who take probability/ statistics courses in other departments may not receive credit for this course. Students taking a double Major or a Minor in Mathematics and Statistics and whose other program requires statistics courses should consult the Mathematics and Statistics undergraduate program advisor.*	**78 BA or BSc Joint Major in Mathematics and Statistics and Computer Science** *Mathematics and Statistics Component* 42.5 COMP 248[3.5]; MAST 217[3] or COMP 232[3]; MAST 218[3], 219[3], 221[3] or COMP 233[3]; MAST 232[3], 234[3], 235[3], 324[3], 331[3], 332[3] or COMP 367[3]; MAST 333[3*], 334[3] or COMP 361[3]; MATH 339[3] *Computer Science Component* *(see §71.85)* 32.5 COMP 228[3], 249[3.5], 335[3], 346[4], 348[3], 352[3], 354[4], 465[3]; ENCS 282[3], 393[3] 3 Chosen from COMP courses with numbers 325 or higher; SOEN 287[3], 321[3], 387[3], 422[4], 423[4], 487[4] *NOTE: The Faculty of Arts and Science and the Gina Cody School of Engineering and Computer Science have created a program of study which combines a comprehensive education in computer science and mathematics. This program resides in both Faculties. In the Gina Cody School of Engineering and Computer Science, it is offered under the aegis of the Bachelor of/Baccalaureate in Computer Science. According to their preferences and aspirations, students may apply either for a Bachelor of/Baccalaureate in Science program, or Bachelor of/Baccalaureate in Arts program or a Bachelor of/ Baccalaureate in Computer Science program. The Computer Science program is described in §71.85.* **NOTE: Students enrolled in a Mathematics and Statistics program who take probability/ statistics courses in other departments may not receive credit for this course. Students taking a double Major or a Minor in Mathematics and Statistics and whose other program requires statistics courses should consult the Mathematics and Statistics undergraduate program advisor.*

Rationale:
The Gina Cody School has removed all Options in Computer Science. This change is made because the Computer Applications Option will be removed under their dossier submission COMP-101.

Resource Implications:

None

UNIVERSITÉ Concordia UNIVERSITY

INTERNAL MEMORANDUM

TO: Dr Sandra Gabriele, Vice-Provost, Innovation in Teaching and Learning
Office of the Provost and Vice-President, Academic Affairs
Chair, Academic Programs Committee

FROM: Dr André Roy, Dean, Faculty of Arts and Science
Chair, Arts and Science Faculty Council

DATE: June 2, 2020

SUBJECT: 2021-22 Undergraduate Calendar Curriculum Changes
Department of Physics
PHYS-26
Changes in Honours in Physics; new courses (PHYS 289, 389); deleted courses (PHYS 290, 291, 293, 297, 391, and 394); miscellaneous course changes

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The following proposal was reviewed and approved at the Arts and Science Faculty Council meeting of May 15, 2020. We request that this proposal be considered at the next meeting of APC.

The **Department of Physics** is proposing two new research courses, PHYS 289 and 389 (*Honours Research Experience I* and *II*). These optional research courses are added to the BSc Honours in Physics as elective credits under the Physics and Biophysics concentrations and aim to distinguish between the BSc Honours and BSc Specialization programs. In an effort to bring the number of program credits in line with other honours programs in the sciences (e.g., Honours in Biology, Honours in Biochemistry), the program electives under the Physics and Biophysics concentration are increased by three credits, bringing the honours tally of credits to a 72-credit value (initially from 69).

The department also recommends removing five obsolete courses from the Undergraduate Calendar: PHYS 290 *Experimental Electronics* (2 credits), PHYS 291 *Experimental Mechanics* (1 credit), PHYS 293 *Experimental Electricity and Magnetism* (1 credit), PHYS 297 *Experimental Optics* (1 credit), PHYS 391 *Introduction to Experimental Microprocessors and Assembly Language Programming* and PHYS 394 *Experimental Atomic Physics* (1 credit), as these have not been offered in many years. Instead, students will take the courses PHYS 230 and 330 (PHYS 230 *Experimental Physics I* and *II*) which overlap in content and represent the same total 6-credit value. These deletions

will remove a large element of confusion among new undergraduate students in physics. Consequent to the course deletions, several prerequisites are also modified to reflect PHYS 230 or 330 over the inactive courses.

Also as part of the clean-up exercise, a number of course notes that are rendered obsolete are also removed (PHYS 245, 252, 253, 345, 355, 367, 377, 459, 460 and 468). In addition, PHYS 391 *Introduction to Experimental Microprocessors and Assembly Language Programming* is deleted, as it has not been offered in many years.

Finally, the names and descriptions of three courses are changed to reflect their updated content. PHYS 200 *Frontiers in Physics - Without Mathematics,* is updated as an online course aimed at a wide audience, PHYS 236 *Numerical Methods in Physics with Python*, introduces physics students to computational methods, and PHYS 440 *Computational Methods in Physics with Python*, further develops the approach towards advanced methods such as artificial neural networks and machine learning.

Thank you for your consideration of this proposal for which there are no additional resource implications.

Reference documents:
FCC 2020.6_PHYS-26
ASFC-2020-4M-D

Department of Physics

PHYS-26

Memo from Chair

Program change

BSc Honours in Physics

Course title and description change; exclusion note removed

PHYS 200 *Frontiers in Physics - Without Mathematics*

Course title, prerequisite, and description change

PHYS 236 *Numerical Methods in Physics with Python*

PHYS 440 *Computational Methods in Physics with Python*

Exclusion note removed

PHYS 245 *Classical Mechanics*

PHYS 252 *Optics*

PHYS 253 *Electricity and Magnetism*

PHYS 345 *Advanced Classical Mechanics*

PHYS 367 *Modern Physics and Relativity*

PHYS 377 *Quantum Mechanics I*

PHYS 459 *Solid State Physics*

PHYS 460 *Chemical Aspects of Biophysics*

New course

PHYS 289 *Honours Research Experience I*

PHYS 389 *Honours Research Experience II*

Course deletion

PHYS 290	*Experimental Electronics* (2 credits)
PHYS 291	*Experimental Mechanics* (1 credit)
PHYS 293	*Experimental Electricity and Magnetism* (1 credit)
PHYS 297	*Experimental Optics*
PHYS 391	*Introduction to Experimental Microprocessors and Assembly Language Programming*
PHYS 394	*Experimental Atomic Physics* (1 credit)

Prerequisite change

PHYS 292	*Experimental Mechanics II*
PHYS 294	*Experimental Electricity and Magnetism II*
PHYS 330	*Experimental Physics II*
PHYS 491	*Experimental Microprocessor Interfacing*
PHYS 494	*Methods of Experimental Physics*
PHYS 495	*Experimental Nuclear Physics*
PHYS 496	*Honours Research Project*
PHYS 497	*Specialization Research Project*

Prerequisite added; exclusion note removed

PHYS 355	*Electronics*
PHYS 392	*Experimental Medical Electronics*
PHYS 468	*Condensed Matter and Nanophysics*

Concordia University
Arts and Science
Department of Physics

January 10, 2020

Department of Physics
Concordia University
7141 Sherbrooke Street West
Montreal, QC H4B 1R6

Dr. Richard Courtemanche
Associate Dean, Academic Programs
Faculty of Arts and Science

Subject: Changes to the Department of Physics Curriculum (Undergraduate)
General maintenance of course listings and two new honours research experience courses

Dear Dr. Courtemanche and Colleagues,

With this letter, we are requesting five (**A**, **B**, **C**, **D**, **E**) sets of changes to our undergraduate programs: **A.** Removing obsolete notes from the calendar; **B.** removing obsolete courses from the calendar; **C.** updating and clarifying prerequisites for several courses. **D.** updating the name and content description of a few courses; and lastly, **E.** proposing two new optional research courses for honours students (experiential learning) in years one and two of their three-year degree. The idea is simple: to allow first and second year honours students to engage in research in the department. It would create a much more attractive honours program by rewarding students for their research activities with program credits and help them build their CV early on. Our honours program is small (around 15 students total) and the one-on-one supervision of the students will be easily manageable (no course section). Rather we aim to attract and retain very talented students, who can act as class leaders for our all of our programs.

The details of the proposed changes are attached below as a text-based version of the provotrack to add clarity given the many details of this proposal, and to incorporate additional rationale where needed.

The Departmental Curriculum Committee approved this proposal on November 29th, 2019. The Departmental Council approved this proposal on December 13th, 2019. Thank you for your consideration, and please do not hesitate to contact us if additional information is needed.

Alexandre Champagne
Chair

A. Removing NOTE remarks from classes where they are out of date (obsolete remarks). The following classes are affected: PHYS 245, PHYS 252, PHYS 253, PHYS 345, PHYS 355, PHYS 367, PHYS 377, PHYS 459, PHYS 460 and PHYS 468. We are requesting that the notes referring to classes that are no longer offered be removed. This is a recurring point of confusion for new Physics students.

B. Removing courses from the calendar courses (obsolete courses). The following classes are no longer offered and have been replaced in the programs by PHYS 230 (3 credits) and PHYS 330 (3 credits): **PHYS 290**, **PHYS 291**, **PHYS 293**, **PHYS 297** and **PHYS 394**. These courses risk becoming a point of confusion for new Physics students. We are requesting that these courses be removed from the Calendar. Furthermore, the class **PHYS 391** is out of date and has not been offered in many years. There is no plan to offer it again. It does not conform with our updated offerings in the Concordia Physics department.

C. Updating the prerequisites for courses where they are out-of-date. PHYS 468 presently has PHYS 377 as a co-requisite and PHYS 459 as a prerequisite. Since PHYS 377 is a prerequisite for PHYS 459, this is redundent. Furthermore, PHYS 468 requires some material from PHYS 478. We are requesting that the co-requisite PHYS 377 be replaced by PHYS 478. In **PHYS 496** and **PHYS 497**, the prerequisites PHYS 290, 291, 293, 297 and 394 have been replaced in the program by PHYS 330 and PHYS 230, and are no longer offered. We are requesting that PHYS 290, 291, 293, 297 and 394 be removed as prerequisites. In **PHYS 355**, a CEGEP level electricity and magnetism course is assumed (from the entrance profile). We are requesting that PHYS 205 be listed explicitly for ECP/mature entry students.

D. Improving the names and descriptions of courses to reflect their updated content. For the course **PHYS 200**, we are requesting that the course name and description be changed as below. This course has not been offered in many years, but will be offered again in 2020-2021. A part-time faculty member who has developed other successful general interest courses is developing this course as an eConcordia course. This description was updated in consultation with the course developer. For the course **PHYS 236**, we are requesting the course name and description be changed as below. This description has not been updated in many years. The new description better reflects modern updates in coding language such as Python. For the course **PHYS 440**, we are requesting that the course name and description be changed as below. We are adding PHYS 236 as a prerequisite since we now provide an introduction to python and computational methods in PHYS 236. This course is now intended as a second course in computational physics. These changes reflect the continuity between these two courses, and the modernization of PHYS 440, for example to connect with artificial intelligence methods in physics (neural networks and machine learning). We replaced the prerequisite PHYS 334 (Thermodynamics) with PHYS 335, (fixing number error). PHYS 335 is Methods of Theoretical Physics II, and covers the mathematical physics required to understand PHYS 440. PHYS 232 is a prerequisite to PHYS 335, therefore the prerequisite is already implied.

The following proposed title and description changes are:

PHYS 200 *Frontiers in Physics - Without Mathematics* (3 credits)
This course is a non-mathematical introduction to cutting-edge physics. Topics may include quantum mechanics, Einstein's theory of relativity, cosmology, and particle physics. Students will investigate fundamental concepts in physics among cutting-edge applications like quantum computing and biomedical imaging. Current physics publications and resources, as well as careers involving physics, are discussed.

PHYS 236 *Numerical Methods in Physics with Python* (3 credits)
Prerequisite: MATH 204, 205. This course is an introduction to computational physics using Python, assuming no background in programming. Topics covered include basic programming, data analysis and visualization, curve fitting, numerical differentiation and integration, solving systems of linear equations, and solving differential equations. Material will be presented in the context of applications in physics, including medical biophysics, fluid mechanics, and optics.

PHYS 440 *Computational Methods in Physics with Python* (3 credits)
Prerequisite: PHYS 236, 335, 377. This course presents advanced computational physics techniques using python. Topics may include Bayesian inference, information theory, regression, Monte-Carlo methods, neural networks, machine learning, and molecular dynamics with a focus on computational solution of advanced problems in Biophysics, Electrodynamics, and Quantum Mechanics.

E. Creating two optional research courses in our honours program, and increasing the number of credits by 3 for our honours programs. We are requesting two new courses, **PHYS 289** and **PHYS 389**, be added as optional courses for first- and second- year honours students. *Sample course outlines for both PHYS 289 and PHYS 389 are attached below.* Since these courses are one-to-one student-to-supervisor projects, each project will be tailored to the student. The objective is to allow first and second year honours students (in either options: "Physics" or "Biophysics") to engage in research, creating very attractive honours programs that distinguish themselves from those at peer institutions. Because the research activities would now be rewarded with credits, it will allow our honours students to develop their career and to dedicate more time to their research (experiential learning). Attracting and retaining such class leaders (honours students) will sustainably improve all of our programs. The courses are optional for the students, and the undergraduate program coordinator will help student identify potential supervisors. These courses are distinct from Science College in two important ways: firstly, Science College is intended for multidisciplinary research, so Honours in Physics students cannot do a project in Physics through the Science College; furthermore, due to the number of credits required and the slightly different requirements, the majority of Honours in Physics students cannot or do not join the Science College. We anticipate the impact on the Science College will be negligible whereas the impact for our most talented students will be

high. No course section is needed (no resource implications). The proposed course descriptions are:

PHYS 289 ***(proposed)*** *Honours Research Experience I* (3 credits)
Prerequisite: enrolment in Honours in Physics; permission of the department. A first supervised research project in Physics or Biophysics. *Intended as an elective physics course for honours students doing research in the department.*

PHYS 389 ***(proposed)*** *Honours Research Experience II* (3 credits)
Prerequisite: PHYS 289; enrolment in Honours in Physics; permission of the department. A second supervised research project in Physics or Biophysics. *Intended as an elective physics course for honours students doing research in the department.*

Minor changes to the honours programs so that students will be able to take the added research classes. We are requesting that the above research courses **PHYS 289** and **PHYS 389** be added to the list of PHYS electives for the honours program as below. We now offer PHYS 440 and 370 every semester, so we are able to increase the number of credits in the honours programs by three. An identical number of credits (72) is already in place for other honours program in the sciences (e.g. Honours in Biology, and Honours in Biochemistry). This allows us to properly accommodate the new research classes in the sequences of honours students and add more distinguishing features between our honours and specialization programs.

72 BSc Honours in Physics ***(proposed change)***
Option A: Physics *on the following line:*
6 Chosen from PHYS **289^3**, 370^3, **389^3**, 436^3, 440^3, 443^3, 445^3, 458^3, 489^3, 498^3
Option B: Biophysics *on the following line:*
9 Chosen from CHEM 235^3, 271^3, 431^3; PHYS **289^3**, 345^3, 370^3, **389^3**, 440^3, 445^3, 459^3, 461^3, 462^3, 463^3, 468^3, 489^3.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

PROGRAM CHANGE: Honours in Physics

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Honours in Physics
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar	**Proposed Text**
~~69~~ **BSc Honours in Physics**	72 **BSc Honours in Physics**
42 Core Program	42 Core Program
6 PHYS 496[6]	6 PHYS 496[6]
AND	AND
Concentration in Physics	*Concentration in Physics*
18 PHYS 330[3], 345[3], 355[3], 459[3], 468[3], 478[3]	18 PHYS 330[3], 345[3], 355[3], 459[3], 468[3], 478[3]
~~3~~ Chosen from PHYS 370[3], 436[3], 440[3], 443[3], 445[3], 458[3], 498[3]	6 Chosen from PHYS 289[3], 370[3], 389[3], 436[3], 440[3], 443[3], 445[3], 458[3], 498[3]
OR	OR
Concentration in Biophysics	*Concentration in Biophysics*
12 BIOL 266[3]; PHYS 260[33], 330[3], 460[3]	12 BIOL 266[3]; PHYS 260[33], 330[3], 460[3]
~~6~~ Chosen from CHEM 235[3], 271[3], 431[3]; PHYS 345[3], 370[3], 440[3], 445[3], 459[3], 461[3], 462[3], 463[3]	9 Chosen from CHEM 235[3], 271[3], 431[3]; PHYS 289[3], 345[3], 370[3], 389[3], 440[3], 445[3], 459[3], 461[3], 462[3], 463[3]
3 Chosen from BIOL 261[3], 340[3], 367[3], 371[3]; PHYS 443[3]	3 Chosen from BIOL 261[3], 340[3], 367[3], 371[3]; PHYS 443[3]

Rationale:
We hope to equalize the number of credits in our honours program with other comparable programs. An identical number of credits (72) is already in place for other honours programs in the sciences (e.g. Honours in Biology, and Honours in Biochemistry). We now offer PHYS 440 and 370 every year, so we are able to increase the number of credits in the honours programs by three. This allows us to properly accommodate the new research classes in the sequences of honours students, and add more distinguishing features between our honours and specialization programs. Since PHYS 289 and PHYS 389 are supervised research courses they are appropriate for both the Physics and Biophysics concentrations.

Resource Implications:
None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 200 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [X] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note Removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 200 ~~***From Particles to Galaxies***~~ (3 credits) This course~~ covers all the major topics in~~ physics ~~including Galileo's role in science, the Newtonian synthesis, optics radiation and absorption of heat, relativity,~~ quantum mechanics, ~~astrophysics and~~ cosmology ~~at a level that a non-science student can grasp.~~ Students ~~in this course are not required to do any mathematical problem solving.~~ ~~*NOTE: Students in programs leading to the BSc degree may not take this course for credit to be applied to their program of concentration.*~~ ~~*NOTE: Students who have received credit for this topic under a PHYS 298 number may not take this course for credit.*~~	**PHYS 200** ***Frontiers in Physics - Without Mathematics*** (3 credits) This course is a non-mathematical introduction to cutting-edge physics. Topics may include quantum mechanics, Einstein's theory of relativity, cosmology, and particle physics. Students investigate fundamental concepts in physics along with cutting-edge applications like quantum computing and biomedical imaging. Current physics publications and resources, as well as careers involving physics, are discussed.

Rationale:
The first note is removed as the course description and content have been revised to include several additional advanced physics concepts (although non-mathematical) and technological applications which make this a relevant course option even for BSc students.

The second note is removed because this topic (modern physics) has not been taught under a PHYS 298 (slot course) in many years (at least 12, and most likely longer - if ever). There is no plan to teach modern physics under PHYS 298 in the future.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 236 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[X] Course Title	[ ] Credit Value	[X] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 236 ***Numerical ~~Analysis~~ in Physics*** (3 credits) ~~Basic numerical analysis, symbolic and numerical computation and~~ programming ~~with a computer language and/or mathematics software program,~~ curve fitting. Numerical ~~solutions to~~ linear and ~~nonlinear ordinary and partial~~ differential equations~~, difference equations~~. ~~Gaussian elimination, LU decomposition, least-square approximation, linear systems of equations. Numerical differentiation and integration.~~	**PHYS 236** ***Numerical Methods in Physics with Python*** (3 credits) Prerequisite: MATH 204, 205. This course is an introduction to computational physics using Python, assuming no background knowledge in programming. Topics may include basic programming, data analysis and visualization, curve fitting, numerical differentiation and integration, solving systems of linear equations, and solving differential equations. Material is presented in the context of applications in physics, including medical biophysics, fluid mechanics, and optics.

Rationale:
The new description better reflects the course as it is actually taught in the Concordia Physics department. The title change reflects the fact that this is not just a numerical analysis class and is instead part of a two-course sequence on Computational Physics (together with PHYS 440). The CEGEP level math classes are assumed in the entrance profile, but need to be listed explicitly for ECP/mature entry students.

Resource Implications:
None.

Other Programs within which course is listed:

This course is also listed in the requirements for the Minor in BioPhysics.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 245 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 245 ***Classical Mechanics*** (3 credits) Prerequisite: MATH 204, 205 or equivalent. Statics of rigid bodies, work and potential functions, motion in uniform field. Particle motion in an accelerated frame, rotation coordinate systems, motion in a resisting medium, small oscillations, damped (harmonic) motion, motion under central forces, mechanics of a rigid body, dynamics of systems of particles, motion of rigid bodies in three dimensions, elements of Lagrangian mechanics. Lectures only. ~~*NOTE: See PHYS 291 for laboratory associated with this course.*~~ ~~*NOTE: Students who have received credit for PHYS 243 or 244 may not take this course for credit.*~~	**PHYS 245** ***Classical Mechanics*** (3 credits) Prerequisite: MATH 204, 205 or equivalent. Statics of rigid bodies, work and potential functions, motion in uniform field. Particle motion in an accelerated frame, rotation coordinate systems, motion in a resisting medium, small oscillations, damped (harmonic) motion, motion under central forces, mechanics of a rigid body, dynamics of systems of particles, motion of rigid bodies in three dimensions, elements of Lagrangian mechanics. Lectures only.

Rationale:
PHYS 243 and 244 have not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 252 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 252 ***Optics*** (3 credits) Prerequisite: PHYS 206. Wave equation, phasors, EM waves, linear, circular and elliptical polarization, polariscope, Malus' law, dichroism, polaroid, polarizing Prism, quarter and half wave plates, wave superposition, interference, Young's double slit experiment, Michelson interferometer, reflectance and transmittance of thin films, interferometers, dispersion, elements of Fourier analysis, diffraction, single slit diffraction, double slit, Fraunhofer and Fresnel limits, diffraction grating, Fresnel diffraction, instruments, introduction to lasers. ~~*NOTE: Students who have received credit for PHYS 352 may not take this course for credit.*~~	**PHYS 252** ***Optics*** (3 credits) Prerequisite: PHYS 206. Wave equation, phasors, EM waves, linear, circular and elliptical polarization, polariscope, Malus' law, dichroism, polaroid, polarizing Prism, quarter and half wave plates, wave superposition, interference, Young's double slit experiment, Michelson interferometer, reflectance and transmittance of thin films, interferometers, dispersion, elements of Fourier analysis, diffraction, single slit diffraction, double slit, Fraunhofer and Fresnel limits, diffraction grating, Fresnel diffraction, instruments, introduction to lasers.

Rationale:
PHYS 352 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 253 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 253 ***Electricity and Magnetism I*** (3 credits) Prerequisite: PHYS 205 or equivalent; MAST 218 or equivalent, previously or concurrently. Electrostatics, Gauss' law, electric potential, curl and divergence of fields, capacitance, RC circuits, Laplace's equation, Legendre equation, method of images, multipole expansion, dielectrics, polarization, dipole moments, electric displacement. ~~*NOTE: See PHYS 293 for laboratory associated with this course.*~~	**PHYS 253** ***Electricity and Magnetism I*** (3 credits) Prerequisite: PHYS 205 or equivalent; MAST 218 or equivalent, previously or concurrently. Electrostatics, Gauss' law, electric potential, curl and divergence of fields, capacitance, RC circuits, Laplace's equation, Legendre equation, method of images, multipole expansion, dielectrics, polarization, dipole moments, electric displacement.

Rationale:
PHYS 293 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 289 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Honours in Physics
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[X] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 20XX/20XX) calendar	**Proposed Text**
	PHYS 289 *Honours Research Experience I* (3 credits) Prerequisite: Enrolment in the Honours in Physics program; permission of the department. This course is a first supervised research project in Physics or Biophysics. Students work under the supervision of a member of the Faculty on either an experimental, computational, or theoretical research project.The learning outcomes include, but are not limited to, developing the ability to do an overview literature review, develop awareness of methods used to trouble shoot research work progress, develop familiarity with organization.and communication of research results, understand the importance of collaborative and ethical research, make a targeted research contribution on a current research project. A formal, written report is required. *NOTE: This course is intended as an elective physics course for honours students doing research in the department.*

Rationale:
This course will allow first year honours students (in either options: “Physics” or “Biophysics”) to engage in research, creating a very attractive honours program that distinguish themselves from those at peer institutions. Because the research activities would now be rewarded with credits, it will allow our honours students to dedicate more time to their research (experiential learning), and advance their career development. Attracting and retaining such class leaders (honours students) will sustainably improve all of our programs. This course is optional for the students, and the undergraduate program coordinator will help student identify potential supervisors. This course is distinct from Science College in two important ways: firstly, Science College is intended for multidisciplinary research, so Honours in Physics students cannot do a project in Physics through the Science College. Secondly, due to the number of credits required and the slightly different requirements, the majority of Honours in Physics students cannot or do not join the Science College. We anticipate the impact on the Science College will be negligible whereas the impact for our most talented students will be high.

A sample course outline for PHYS 289 is attached. Since this course is a one-to-one student-research supervisor project, each project will be tailored to the student.

The workload implications will be managed as per the official Faculty of Arts and Science policy which is already used for several similar courses (e.g. PHYS 496 Honours Research Project (6 credits), PHYS 497 Specialization Research Project (3 credits), as well as the Science College Research courses: SCOL 290 (3 credits), SCOL 390 (6 credits), SCOL 490 (6 credits).

The policy is simple, one-on-one supervision of a research student by a faculty member in one of the above courses gives a 0.5 teaching remission for a 6-credit research course (e.g. PHYS 496), and a pro-rated 0.25 remission for a 3-credit courses.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 290 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: None
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[X] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
~~**PHYS 290 — *Experimental Electronics*** (2 credits) ~~Prerequisite: PHYS 205, 225 or equivalent. A practical laboratory course in electronics. This course explores the usage of electronic measuring instruments and components. Experiments include power supplies, transistor amplifiers, operational amplifiers, oscillators, audio and radio frequency amplifiers. *NOTE: Students who have received credit for PHYS 295 and 296 may not take this course for credit.*~~	

Rationale:
PHYS 290 has been replaced by PHYS 230 and 330.It was last offered as a regular course approximately four years ago. Students have been permitted to register to ensure any student wishing to take the classes has had an opportunity prior to discontinuing the classes. Last year the registration for PHYS 290 was 2 (Summer), 1 (Fall), 0 (Winter).

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 291 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: None
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[X] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
~~**PHYS 291 *Experimental Mechanics I*** (1 credit) Prerequisite: PHYS 245 previously or concurrently. A laboratory course in mechanics. Experiments include pendulum, coefficient of restitution, centrifugal force, rotational inertia, inelastic impact.~~	

Rationale:
PHYS 291 has been replaced by PHYS 230 and 330.It was last offered as a regular course approximately four years ago. Students have been permitted to register to ensure any student wishing to take the classes has had an opportunity prior to discontinuing the classes. Last year the registration for PHYS 291 was 0 (Summer), 2 (Fall), 0 (Winter).

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 292 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 292 ***Experimental Mechanics II*** (1 credit) Prerequisite: PHYS 2~~91~~. A laboratory course in mechanics. Experiments include the use of air tracks to study acceleration, collisions, dissipative forces, and periodic motion. Other experiments include viscosity and surface tension of liquids.	**PHYS 292** ***Experimental Mechanics II*** (1 credit) Prerequisite: PHYS 230. A laboratory course in mechanics. Experiments include the use of air tracks to study acceleration, collisions, dissipative forces, and periodic motion. Other experiments include viscosity and surface tension of liquids.

Rationale:
PHYS 291 has been replaced by PHYS 230 and 330.It was last offered as a regular course approximately four years ago. Students have been permitted to register to ensure any student wishing to take the classes has had an opportunity prior to discontinuing the classes. Last year the registration for PHYS 291 was 0 (Summer), 2 (Fall), 0 (Winter).

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 293 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: None
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[X] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
~~**PHYS 293 — *Experimental Electricity and Magnetism I*** (1 credit)~~ ~~Prerequisite: PHYS 253 previously or concurrently. A laboratory course in electricity and magnetism. Experiments include motion of electrons in electric and magnetic fields, exponential relaxation, damped oscillations, resonance, non-linearity, negative resistance.~~	

Rationale:
PHYS 293 has been replaced by PHYS 230 and 330.It was last offered as a regular course approximately four years ago. Students have been permitted to register to ensure any student wishing to take the classes has had an opportunity prior to discontinuing the classes. Last year the registration for PHYS 293 was 0 (Summer), 2 (Fall), 1 (Winter).

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 294 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 294 ***Experimental Electricity and Magnetism II*** (1 credit) Prerequisite: PHYS 2~~93~~. A laboratory course in electricity and magnetism. Experiments include the transistor, amplification and frequency response, transient response and negative feedback, positive feedback and oscillation, periodic structures.	**PHYS 294** ***Experimental Electricity and Magnetism II*** (1 credit) Prerequisite: PHYS 230. A laboratory course in electricity and magnetism. Experiments include the transistor, amplification and frequency response, transient response and negative feedback, positive feedback and oscillation, periodic structures.

Rationale:
PHYS 290, 291, 293, 297 and 394 have been replaced by PHYS 230 and 330. Removal from the calendar will eliminate a source of confusion. PHYS 293 was last offered 4 years ago.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 297 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: None
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[X] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
~~**PHYS 297 — *Experimental Optics*** (1 credit) ~~Prerequisite: PHYS 252 previously or concurrently. An experimental course in optics. Experiments include diffraction, optical instruments, resonance, and various experiments using lasers. Laboratory only, 10 experiments.~~ ~~*NOTE: Students who have received credit for PHYS 392 may not take this course for credit.*~~	

Rationale:
PHYS 297 has been replaced by PHYS 230 and 330. It was last offered as a regular course approximately four years ago. Students have been permitted to register to ensure any student wishing to take the classes has had an opportunity prior to discontinuing the classes. Last year the registration for PHYS 297 was 0 (Summer), 1 (Fall), 1 (Winter).

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 330 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 330 ***Experimental Physics II*** (3 credits) Prerequisite: PHYS 230~~; or PHYS 291, 293, 297~~. This course builds on the competencies developed in Experimental Physics I, introducing various physics experiments that require a higher level of experimental skills and deeper insight into how an experiment should be conducted. The data analysis required by these experiments is more involved than that of Experimental Physics I. Students develop their scientific communication skills through the production of reports and an oral presentation. ~~*NOTE: Students who have received credit for PHYS 290 or 394 may not take this course for credit.*~~	**PHYS 330** ***Experimental Physics II*** (3 credits) Prerequisite: PHYS 230. This course builds on the competencies developed in Experimental Physics I, introducing various physics experiments that require a higher level of experimental skills and deeper insight into how an experiment should be conducted. The data analysis required by these experiments is more involved than that of Experimental Physics I. Students develop their scientific communication skills through the production of reports and an oral presentation.

Rationale:
PHYS 290, 291, 293, 297 and 394 have been replaced by PHYS 230 and 330. Removal from the calendar will eliminate a source of confusion. These classes were last offered as a regular course approximately four years ago. Students have been permitted to register to ensure any student wishing to take the classes has had an opportunity prior to discontinuing the classes.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 345 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 345 ***Advanced Classical Mechanics*** (3 credits) Prerequisite: PHYS 232 or equivalent; PHYS 245 or equivalent; MAST 219. Survey of Newtonian mechanics; D'Alembert's principle and Lagrangian formulation; variational formulation and Hamilton's principle. Hamiltonian formulation, canonical transformations, Poisson brackets (connection to quantum mechanics); central force motion; planetary motion; scattering in a central field, dynamics of rigid bodies; Euler's equations; Hamilton-Jacobi theory, applications. Introduction to non-linear mechanics. ~~*NOTE: Students who have received credit for PHYS 346 may not take this course for credit.*~~	**PHYS 345** ***Advanced Classical Mechanics*** (3 credits) Prerequisite: PHYS 232 or equivalent; PHYS 245 or equivalent; MAST 219. Survey of Newtonian mechanics; D'Alembert's principle and Lagrangian formulation; variational formulation and Hamilton's principle. Hamiltonian formulation, canonical transformations, Poisson brackets (connection to quantum mechanics); central force motion; planetary motion; scattering in a central field, dynamics of rigid bodies; Euler's equations; Hamilton-Jacobi theory, applications. Introduction to non-linear mechanics.

Rationale:
PHYS 346 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 355 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 355 ***Electronics*** (3 credits) Basic circuit analysis, network theorems, maximum power transfer, diode characteristics and circuits, power supply designs, transistor characteristics, incremental equivalent circuits, input and output impedance calculations, emitter follower and Darlington amplifiers, power amplifiers, dc stabilization and negative feedback, operational amplifiers, phase detection, frequency multiplier and special circuits. Lectures only. ~~*NOTE: See PHYS 290 for laboratory associated with this course.*~~	**PHYS 355** ***Electronics*** (3 credits) Prerequisite: PHYS 205. Basic circuit analysis, network theorems, maximum power transfer, diode characteristics and circuits, power supply designs, transistor characteristics, incremental equivalent circuits, input and output impedance calculations, emitter follower and Darlington amplifiers, power amplifiers, dc stabilization and negative feedback, operational amplifiers, phase detection, frequency multiplier and special circuits. Lectures only.

Rationale:
This CEGEP level electricity and magnetism class is assumed in the entrance profile, but it needs to be listed explicitly as a prerequisite for ECP/mature entry students.
The note is outdated as the referenced course no longer exists in the calendar and has not been offered in several years. This is a recurring point of confusion for students.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 367 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 367 ***Modern Physics and Relativity*** (3 credits) Prerequisite: PHYS 205, 206 or equivalent. *Relativity:* Lorentz transformations (revision), space-time and four-tensors, Minkowski map of space-time, four-velocity and four-acceleration, four-momentum, equivalence of mass and energy, angular momentum, three- and four-force, formal structure of Maxwell's theory, transformation of E and B, electromagnetic energy tensor. *Atomic Physics:* Introduction to the theory of blackbody radiation, the photoelectric effect, the Compton effect, De Broglie's postulate, Bohr's postulates, Bohr's and Sommerfeld's model, Schrödinger's quantum mechanics, Schrödinger's equation, Bohr's interpretation of the wavefunctions, expectation values, time-independence, eigenfunctions and eigenvalues, energy quantization; solutions of the time-independent Schrödinger's equation free particle, and simple one-dimensional potentials. ~~*NOTE: See PHYS 394 for laboratory associated with this course.*~~	**PHYS 367** ***Modern Physics and Relativity*** (3 credits) Prerequisite: PHYS 205, 206 or equivalent. *Relativity:* Lorentz transformations (revision), space-time and four-tensors, Minkowski map of space-time, four-velocity and four-acceleration, four-momentum, equivalence of mass and energy, angular momentum, three- and four-force, formal structure of Maxwell's theory, transformation of E and B, electromagnetic energy tensor. *Atomic Physics:* Introduction to the theory of blackbody radiation, the photoelectric effect, the Compton effect, De Broglie's postulate, Bohr's postulates, Bohr's and Sommerfeld's model, Schrödinger's quantum mechanics, Schrödinger's equation, Bohr's interpretation of the wavefunctions, expectation values, time-independence, eigenfunctions and eigenvalues, energy quantization; solutions of the time-independent Schrödinger's equation free particle, and simple one-dimensional potentials.

Rationale:
The note is outdated as the referenced course no longer exists in the calendar and has not been offered in several years. This is a recurring point of confusion for students. Moreover, lab classes in the Concordia physics department are standalone classes (this is generally true elsewhere as well) and the reference to a lab component obscures this fact.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 377 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 377 ***Quantum Mechanics I*** (3 credits) Prerequisite: PHYS 367. Schrödinger equation, probabilistic interpretation, normalization, expectation values, the uncertainty principle, stationary states, the free particle, infinite square well, the finite square well, the harmonic oscillator, the delta potential, the scattering matrix, vector spaces, postulates of quantum mechanics, operators and eigenvectors, compatible observables, the uncertainty relations, time-evolution of states, Ehrenfest's equations, the variational principle, nondegenerate time-independent perturbation theory, degenerate perturbation theory, spherical coordinates and the hydrogen atom, angular momentum, spin, addition of angular momenta. ~~*NOTE: Students who have received credit for PHYS 477 may not take this course for credit.*~~	**PHYS 377** ***Quantum Mechanics I*** (3 credits) Prerequisite: PHYS 367. Schrödinger equation, probabilistic interpretation, normalization, expectation values, the uncertainty principle, stationary states, the free particle, infinite square well, the finite square well, the harmonic oscillator, the delta potential, the scattering matrix, vector spaces, postulates of quantum mechanics, operators and eigenvectors, compatible observables, the uncertainty relations, time-evolution of states, Ehrenfest's equations, the variational principle, nondegenerate time-independent perturbation theory, degenerate perturbation theory, spherical coordinates and the hydrogen atom, angular momentum, spin, addition of angular momenta.

Rationale:
PHYS 477 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 389 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: None
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[X] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 20XX/20XX) calendar	**Proposed Text**
	PHYS 389 *Honours Research Experience II* (3 credits**)** Prerequisite: PHYS 289, Enrolment in the Honours in Physics program; permission of the department. This course is a second supervised research project in Physics or Biophysics. Students work under the supervision of a member of the Faculty on either an experimental, computational, or theoretical research project. The learning outcomes include, but are not limited to, developing the ability to conduct a detailed literature review, develop productive methods to trouble shoot research work progress, learn to organize and communicate research results at an intermediate level, develop the ability to work collaborative and ethically, and make a targeted, but substantive, research contribution on a current research project. A formal, written report is required. *NOTE: This course is intended as an elective physics course for honours students doing research in the department.*

Rationale:
This course will allow second year honours students (in either options: “Physics” or “Biophysics”) to engage in research, creating a very attractive honours program that distinguish themselves from those at peer institutions. Because the research activities would now be rewarded with credits, it will allow our honours students to dedicate more time to their research (experiential learning), and advance their career development. Attracting and retaining such class leaders (honours students) will sustainably improve all of our programs. The course is optional for students, and the undergraduate program coordinator will help student identify potential supervisors. These courses are distinct from Science College in two important ways: firstly, Science College is intended for multidisciplinary research, so Honours in Physics students cannot do a project in Physics through the Science College. Secondly, due to the number of credits required and the slightly different requirements, the majority of Honours in Physics students cannot or do not join the Science College. We anticipate the impact on the Science College will be negligible whereas the impact for our most talented students will be high.

A sample course outline for PHYS 389 is attached. Since this course is a one-to-one student-research supervisor project, each project will be tailored to the student.

The workload implications will be managed as per the official Faculty of Arts and Science policy which is already used for several similar courses (e.g. PHYS 496 Honours Research Project (6 credits), PHYS 497 Specialization Research Project (3 credits), as well as the Science College Research courses: SCOL 290 (3 credits), SCOL 390 (6 credits), SCOL 490 (6 credits).

The policy is simple, one-on-one supervision of a research student by a faculty member in one of the above courses gives a 0.5 teaching remission for a 6-credit research course (e.g. PHYS 496), and a pro-rated 0.25 remission for a 3-credit courses.

Resource Implications: None.
Other Programs within which course is listed: None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 391 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: None
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[X] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
~~**PHYS 391 — *Introduction to Experimental Microprocessors and Assembly Language Programming*** (3 credits)~~ ~~Prerequisite: PHYS 235; COMP 212 or equivalent. Eight-bit microprocessor architecture: opcodes, addressing modes, memory mapped I/O, vectored interrupts, etc. The MS/DOS operating system, word processing, Motorola assembly language: pseudocodes, labels, sub-routines, interrupt service routines, structured programming techniques. Cross assemblers, RS232 serial transmission of ASCII and binary data to remote computers. Laboratory only.~~ ~~*NOTE: Students who have received credit for PHYS 396 may not take this course for credit.*~~	

Rationale:
This class has not been offered in at least 10 years and we have no record of having offered it. There is no entry for it in the SIS, which suggests it may not have been offered since as early as the 1960s. We recommend it be removed.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 392 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 392 ***Experimental Medical Electronics*** (3 credits) Prerequisite: PHYS ~~290~~ or 296, or equivalent. A laboratory course in the maintenance and use of medical instruments, including ECG monitor, electrocardiograph, cardio-tachometer, blood-pressure recorder, respiration-rate recorder, and clinical thermometer. The component parts of the instruments are studied first, and then the instruments are constructed and tested. Laboratory only. ~~*NOTE: Students who have received credit for PHYS 397 may not take this course for credit.*~~	**PHYS 392** ***Experimental Medical Electronics*** (3 credits) Prerequisite: PHYS 296 or 330, or equivalent. A laboratory course in the maintenance and use of medical instruments, including ECG monitor, electrocardiograph, cardio-tachometer, blood-pressure recorder, respiration-rate recorder, and clinical thermometer. The component parts of the instruments are studied first, and then the instruments are constructed and tested. Laboratory only.

Rationale:
PHYS 290, 291, 293, 297 and 394 have been replaced by PHYS 230 and 330. Removal from the calendar will eliminate a source of confusion.
The note is outdated as the referenced course no longer exists in the calendar and has not been offered in several years.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 394 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: None
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[X] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
~~**PHYS 394 — *Experimental Atomic Physics*** (1 credit) Prerequisite: PHYS 226 or equivalent, or permission of the Department. An experimental course in atomic physics. Experiments include the Frank-Hertz experiment, the Zeeman effect, mass spectrometer, and some X-ray work. Laboratory only, 10 experiments.~~	

Rationale:
PHYS 394 has been replaced by PHYS 230 and 330.It was last offered as a regular course approximately four years ago. Students have been permitted to register to ensure any student wishing to take the classes has had an opportunity prior to discontinuing the classes. Last year the registration for PHYS 394 was 2 (Summer), 1 (Fall), 1 (Winter).

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 440 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[X] Course Title	[ ] Credit Value	[X] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 440 ***Computational Methods ~~and Simulations~~ in Physics*** (3 credits) Prerequisite: PHYS ~~232, 334,~~ 377. ~~The first part of the~~ course ~~fully develops the UNIX/ Fortran/C code for problem solving through direct experience with problems in mechanics, electromagnetism, and quantum mechanics. Applications~~ include ~~finite square well, simple pendulum, charge distribution, phase space, anharmonic oscillator, vibrating string, etc. The second part of the course introduces the~~ Monte Carlo and molecular dynamics ~~methods, first-principles calculations for materials, electronic properties,~~ electrodynamics and ~~electrical circuit simulations, and biophysics simulations.~~	**PHYS 440** ***Computational Methods in Physics with Python*** (3 credits) Prerequisite: PHYS 236, 335, 377. This course presents advanced computational physics techniques using Python. Topics may include Bayesian inference, information theory, regression, Monte-Carlo methods, neural networks, machine learning, and molecular dynamics with a focus on computational solution of advanced problems in biophysics, electrodynamics, and quantum mechanics.

Rationale:
We are adding PHYS 236 as a prerequisite since we now provide an introduction to python and computational methods in PHYS 236. This course is now intended as a second course in computational physics. These changes reflect the continuity between these two courses, and the modernization of PHYS 440, for example to connect with artificial intelligence methods in physics (neural networks and machine learning). We replaced the prerequisite PHYS 334 (Thermodynamics) with PHYS 335; PHYS 334 was an error. PHYS 335 is Methods of Theoretical Physics II, and covers the mathematical physics required to understand PHYS 440. PHYS 232 is a prerequisite to PHYS 335, thus it is not needed to specify PHYS 232 as a separate prerequisite.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 459 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 459 ***Solid State Physics*** (3 credits) Prerequisite: PHYS 377 previously or concurrently. Drude and Sommerfeld theory of metals, crystal lattices, reciprocal lattice, electron levels in periodic potentials, tight-binding method, semiclassical model of electron dynamics and of conduction in metals, relaxation-time approximation, Boltzmann equation, homogeneous semiconductors, lattice vibrations, Fermi surface, cohesive energy. ~~*NOTE: Students who have received credit for PHYS 358 may not take this course for credit.*~~	**PHYS 459** ***Solid State Physics*** (3 credits) Prerequisite: PHYS 377 previously or concurrently. Drude and Sommerfeld theory of metals, crystal lattices, reciprocal lattice, electron levels in periodic potentials, tight-binding method, semiclassical model of electron dynamics and of conduction in metals, relaxation-time approximation, Boltzmann equation, homogeneous semiconductors, lattice vibrations, Fermi surface, cohesive energy.

Rationale:
PHYS 358 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 460 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 460 ***Chemical Aspects of Biophysics*** (3 credits) Prerequisite: PHYS 253; PHYS 334 previously or concurrently. Stabilizing protein structures; bonding and nonbonding interactions; energy profiles; Ramachandran plot; stabilization through protonation-deprotonation. Interaction of macromolecules with solvents. Thermodynamics of protein folding. Ligand binding, Marcus-theory of biological electron transfer. Examples of modern biophysical techniques: electronic spectroscopies (absorption, fluorescence), X-ray absorption spectroscopy, NMR and EPR spectroscopy, IR and Raman spectroscopy, circular dicroism, differential scanning calorimetry. ~~*NOTE: Students who have received credit for PHYS 360 may not take this course for credit.*~~ *NOTE: Students enrolled in a BSc Honours or Specialization in Biochemistry may not take this course for credit.*	**PHYS 460** ***Chemical Aspects of Biophysics*** (3 credits) Prerequisite: PHYS 253; PHYS 334 previously or concurrently. Stabilizing protein structures; bonding and nonbonding interactions; energy profiles; Ramachandran plot; stabilization through protonation-deprotonation. Interaction of macromolecules with solvents. Thermodynamics of protein folding. Ligand binding, Marcus-theory of biological electron transfer. Examples of modern biophysical techniques: electronic spectroscopies (absorption, fluorescence), X-ray absorption spectroscopy, NMR and EPR spectroscopy, IR and Raman spectroscopy, circular dicroism, differential scanning calorimetry. *NOTE: Students enrolled in a BSc Honours or Specialization in Biochemistry may not take this course for credit.*

Rationale:
PHYS 360 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 468 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note Removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 468 ***Condensed Matter and Nanophysics*** (3 credits) Prerequisite: PHYS ~~377~~ previously or concurrently~~; PHYS 459~~. Review of phonon modes and electron band structure. Quantum condensed-matter topics: Hartree-Fock, mesoscopic quantum transport theory (quantum dots, 1D systems, 2D systems), superconductivity, the quantum Hall effects, and weak localization. ~~*NOTE: Students who have received credit for PHYS 467 may not take this course for credit.*~~	**PHYS 468** ***Condensed Matter and Nanophysics*** (3 credits) Prerequisite: PHYS 459; PHYS 478 previously or concurrently. Review of phonon modes and electron band structure. Quantum condensed-matter topics: Hartree-Fock, mesoscopic quantum transport theory (quantum dots, 1D systems, 2D systems), superconductivity, the quantum Hall effects, and weak localization.

Rationale:
PHYS 377 Quantum Mechanics I is now a prerequisite for PHYS 459 Solid State Physics. PHYS 468 Condensed Matter and Nanophysics requires some knowledge from PHYS 478 Quantum Mechanics II.
PHYS 467 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 491 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[X] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 491 ***Experimental Microprocessor Interfacing*** (3 credits) Prerequisite: PHYS 390~~; PHYS 391 or equivalent~~. Address decoding, multiplexing, and demultiplexing with TTL integrated circuits. Address decoding circuits, drivers, and receivers. Parallel, serial and non-TTL I/O. Breadboarding, wire-wrapping, and soldering techniques. The use of oscilloscopes, logic probes, and computers for circuit trouble-shooting. Drawing schematic diagrams. Timing diagrams. Data sheets. Laboratory only.	**PHYS 491** ***Experimental Microprocessor Interfacing*** (3 credits) Prerequisite: PHYS 390. Address decoding, multiplexing, and demultiplexing with TTL integrated circuits. Address decoding circuits, drivers, and receivers. Parallel, serial and non-TTL I/O. Breadboarding, wire-wrapping, and soldering techniques. The use of oscilloscopes, logic probes, and computers for circuit trouble-shooting. Drawing schematic diagrams. Timing diagrams. Data sheets. Laboratory only.

Rationale:
PHYS 391 has not been offered in at least 10 years and we have no record of having offered it. There is no entry for it in the SIS, which suggests it may not have been offered since as early as the 60s. We hope to remove it from the calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 494 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 494 ***Methods of Experimental Physics*** (3 credits) Prerequisite: PHYS ~~290, 293, 394 or equivalent~~, or permission of the Department. A supervised research project which may include experiments in nuclear physics, laser and fibre-optics, solid state physics, ultrasonics, or thermal physics. A technical report is required.	**PHYS 494** ***Methods of Experimental Physics*** (3 credits) Prerequisite: PHYS 330, or permission of the Department. A supervised research project which may include experiments in nuclear physics, laser and fibre-optics, solid state physics, ultrasonics, or thermal physics. A technical report is required.

Rationale:
PHYS 290, 291, 293, 297 and 394 have been replaced by PHYS 230 and 330. These courses have not been offered in at least 10 years and we have no record of having offered it. They no longer exist in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 495 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 495 ***Experimental Nuclear Physics*** (1 credit) Prerequisite: PHYS 3~~94~~. A laboratory course in nuclear physics. Experiments include gamma- and beta-ray spectroscopy, nuclear magnetic resonance, half-life determination, nuclear activities. Laboratory only, 10 experiments.	**PHYS 495** ***Experimental Nuclear Physics*** (1 credit) Prerequisite: PHYS 330. A laboratory course in nuclear physics. Experiments include gamma- and beta-ray spectroscopy, nuclear magnetic resonance, half-life determination, nuclear activities. Laboratory only, 10 experiments.

Rationale:
PHYS 290, 291, 293, 297 and 394 have been replaced by PHYS 230 and 330. PHYS 394 has not been offered in at least 10 years and we have no record of having offered it. It no longer exists in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 496 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 496 ***Honours Research Project*** (6 credits) Prerequisite: PHYS 330; ~~or PHYS 290, 291, 293, 297, 394;~~ and enrolment in Honours in Physics; and 45 credits completed in Physics; or permission of the Department. A research project for honours students that is carried out on a special topic in physics, biophysics, or applied physics under the supervision of a faculty member.	**PHYS 496** ***Honours Research Project*** (6 credits) Prerequisite: PHYS 330; and enrolment in Honours in Physics; and 45 credits completed in Physics; or permission of the Department. A research project for honours students that is carried out on a special topic in physics, biophysics, or applied physics under the supervision of a faculty member.

Rationale:
PHYS 290, 291, 293, 297 and 394 have been replaced by PHYS 230 and 330. Removal from the calendar will eliminate a source of confusion. These courses have not been offered in at least 10 years and we have no record of having offered it. They no longer exist in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PHYS-26** VERSION: 6

COURSE CHANGE: PHYS 497 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Arts and Science
Department: Physics
Program: Core Program
Degree: BSc
Calendar Section/Graduate Page Number: 31.230

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Note removed

Present Text (from 2020/2021) calendar	**Proposed Text**
PHYS 497 ***Specialization Research Project*** (3 credits) Prerequisite: PHYS 330; ~~or PHYS 290, 291, 293, 297, 394;~~ and enrolment in the Specialization in Physics; and 45 credits completed in Physics; or permission of the Department. This is an independent studies course for advanced specialization students in which a special topic in physics, biophysics, or applied physics is studied under the supervision of a faculty member. The student is required to write a report and give a brief presentation.	**PHYS 497** ***Specialization Research Project*** (3 credits) Prerequisite: PHYS 330; and enrolment in the Specialization in Physics; and 45 credits completed in Physics; or permission of the Department. This is an independent studies course for advanced specialization students in which a special topic in physics, biophysics, or applied physics is studied under the supervision of a faculty member. The student is required to write a report and give a brief presentation.

Rationale:
PHYS 290, 291, 293, 297 and 394 have been replaced by PHYS 230 and 330. Removal from the calendar will eliminate a source of confusion. These course have not been offered in at least 10 years and we have no record of having offered it. They no longer exist in the undergraduate calendar.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PHYS 289 Honours Research Experience I (3 credits)

Honours Research Experience I. *Prerequisite: Enrollment in the Honours Physics program; permission of the department.* This course is a first supervised research project in Physics or Biophysics. The student will work under the supervision of a member of the Faculty on either an experimental, computational, or theoretical research project. The learning outcomes include, but are not limited to, developing the ability to do an overview literature review, develop awareness of methods used to trouble shoot research work progress, develop familiarity with organization and communication of research results, understand the importance of collaborative and ethical research, make a targeted research contribution on a current research project. A formal, written report is required. *NOTE: This course is intended as an elective physics course for honours students doing research in the department.*

Objectives and Registration Procedure
This 3 credit course will introduce first-year Honours Student to research under the direct supervision of a research-active faculty member (experimental, computational, or theoretical) in Physics or Biophysics.

The purpose of this course is to offer an introduction to research in a University setting, at a level appropriate for a first year Honours student. The student, with help of the Undergraduate Academic Adviser or Undergraduate Program Director, will identify potential supervisors and discuss with them. A detailed one page project description co-signed by the student and supervisor will be submitted to the Department before the registration. The Department (UPD) will verify that the project is sound and meets most of the learning outcomes listed below.

Learning outcomes

For all projects:

- Be able to do an overview literature review of major recent publications in the field. Cite, read, and interpret the relevant scientific literature at an introductory level.
- Become aware of methods to trouble shoot their research work progress, and with extensive supervision be able to reach a useful scientific research result.
- Familiarize themselves with rigorous organization and communication tools and methods to report their research results (e.g. scientific plots, lab and online notebooks, documented programming code, latex equations and notes, online archiving).
- Become aware of the importance to how to work collaboratively, inclusively, and ethically as part of a research team.
- Make a small and targeted contribution to a current research project pursued by the supervisor via the development of a measurement, applied tool, code, method, or calculation in physics or biophysics.
- Produce a brief final scientific report which includes background, methods, results, a brief discussion, and citations.

For experimental projects:

- Develop the ability to use the use nearly automated or staff-supported advanced physics/biophysics experimental apparatus and acquire high-resolution data.

For computational projects:

- Develop an introductory knowledge of computational physics methods including: simple numerical methods, automated statistical analysis, a programming language and libraries used in physics or biophysics research (python, matlab, mathematica, C++, etc.).

For theoretical projects:

- Develop simple analytical models for a modern physics or biophysics research question, and calculate useful exact or approximate solutions under physical limits which simplify the problem.

Required Text

Relevant textbooks and research articles suited to the project will be provided by the research supervisor.

Evaluation of the course

- 25% Midterm evaluation by the supervisor of the progress and documented research output
- 25% Final evaluation by the supervisor of the progress and document research output
- 50% Written final project report, graded by the Supervisor and UPD

PHYS 389 Honours Research Experience II (3 credits)

Honours Research Experience II. *Prerequisite: PHYS 289, Enrollment in the Honours Physics program; permission of the department.* This course is a second supervised research project in Physics or Biophysics. The student will work under the supervision of a member of the Faculty on either an experimental, computational, or theoretical research project. The learning outcomes include, but are not limited to, developing the ability to conduct a detailed literature review, develop productive methods to trouble shoot research work progress, learn to organize and communicate research results at an intermediate level, develop the ability to work collaborative and ethically, and make a targeted, but substantive, research contribution on a current research project. A formal, written report is required. *NOTE: This course is intended as an elective physics course for honours students doing research in the department.*

Objectives and Registration Procedure
This 3 credit course will further develop research skills of second-year Honours Student under the direct supervision of a research-active faculty member (experimental, computational, or theoretical) in Physics or Biophysics.

The purpose of this course is to offer a research experience in a University setting, at a level appropriate for a second year Honours student. The student, with help of the Undergraduate Academic Adviser or Undergraduate Program Director, will identify potential supervisors and discuss with them. A detailed one page project description co-signed by the student and supervisor will be submitted to the Department before the registration. The Department (UPD) will verify that the project is sound and meets most of the learning outcomes listed below.

Learning outcomes

For all projects:

- Be able to do a comprehensive literature review of publications in the field. Cite, read, and interpret the relevant scientific literature at an intermediate level.
- Develop good methods to trouble shoot their research work progress, and with moderate supervision be able to reach a useful scientific research result.
- Become fluent with rigorous organization and communication tools and methods to report their research results (e.g. scientific plots, lab and online notebooks, documented programming code, latex equations and notes, online archiving).
- Demonstrate in their work the ability to work collaboratively, inclusively, and ethically as part of a research team.
- Make a substantive, but targeted, contribution to a current research project pursued by the supervisor via the development of a measurement, applied tool, code, method, or calculation in physics or biophysics.
- Produce a moderately extensive final scientific report which includes background, methods, results, substantive discussion, and a detailed citation list.

For experimental projects:

- Develop the ability to use independently advanced physics/biophysics experimental apparatus and acquire high-resolution data.

For computational projects:

- Develop an intermediate knowledge of computational physics methods including: intermediate numerical methods, intermediate statistical analysis, some advanced functions of a programming language and libraries used in physics or biophysics research (python, matlab, mathematica, C++, etc.), and be able to write new code which is properly documented.

For theoretical projects:

- Develop simple analytical models for a modern physics or biophysics research question, and calculate useful exact or approximate solutions which have a broad range of applicability.

Required Text

Relevant textbooks and research articles suited to the project will be provided by the research supervisor.

Evaluation of the course

- 25% Midterm evaluation by the supervisor of the progress and documented research output
- 25% Final evaluation by the supervisor of the progress and document research output
- 50% Written final project report, graded by the Supervisor and UPD

UNIVERSITÉ Concordia UNIVERSITY

INTERNAL MEMORANDUM

TO: Dr Sandra Gabriele, Vice-Provost, Innovation in Teaching and Learning
Office of the Provost and Vice-President, Academic Affairs
Chair, Academic Programs Committee

FROM: Dr André Roy, Dean, Faculty of Arts and Science
Chair, Arts and Science Faculty Council

DATE: June 2, 2020

SUBJECT: 2021-22 Undergraduate Calendar Curriculum Changes
Department of Psychology
PSYC-18
Admission GPA requirement change

The following proposal was reviewed and approved at the Arts and Science Faculty Council meeting of May 15, 2020. We request that this proposal be considered at the next meeting of APC.

The **Department of Psychology** is modifying the GPA entry requirement to its honours programs from the current threshold set at 3.5 to a threshold of 3.7 (aligned with a letter grade of A-) and to the specialization programs from a threshold of 3.0 to a threshold of 3.2 (corresponding to a letter grade of B+). This GPA entry requirement change would permit to adjust the size of the honours and specialization cohorts. With smaller cohorts of students eligible for each program, this will serve to heighten the learning experience and lead to a stronger supervision and research performance. The higher GPA requirement would warrant that the best students qualify to these programs, ensuring continued excellence.

Thank you for your consideration of this proposal for which there are no additional resource implications.

Reference documents:
FCC 2019.6_PSYC-18
ASFC-2020-4M-E

Department of Psychology

PSYC-18

Memo from Chair

Programs text

Admission GPA Requirement Change (Honours and Specialization in Psychology)

MEMO

To: Richard Courtemanche, Associate Dean Academic Programs, Faculty of Arts and Science; Nicole Freeman, Academic Programs Assistant, Faculty of Arts and Science

From: Aaron Johnson, Chair, Department of Psychology; Erin Barker, Undergraduate Curriculum Committee Chair, Department of Psychology

Date: April 17, 2020

Subject: Updated request for calendar changes for GPA requirements for honours and specialization programs in the Department of Psychology

The Department of Psychology approved the following changes at the Undergraduate Curriculum Committee and at the Department Council meeting of Tuesday, October 22, 2019. Committee members present at the meetings voted separately on each motion and voted unanimously to support each motion. Consequently, we ask that the department can move forward, with the assistance of Dr. Erin Barker (Chair of the Psychology Department Undergraduate Curriculum Committee), to make the appropriate changes to the academic calendar.

The first motion pertained to changing the GPA for our honours program from a Psychology GPA=3.5 to a Psychology GPA=3.7. The second pertained to changing the GPA for our specialization program from Psychology GPA=3.0 to GPA=3.2.

The motivation for the change in the GPA grade for honours is to improve the quality of the honours experience. By aligning the GPA entry point with an A- letter grade, the Department would be admitting those students with "outstanding" performance across at least 30 credits of psychology courses into the final year honours courses.

Based on the GPAs of all current honours students across all years (N=315), 35 (11%) have a GPA between 3.5 and 3.69 and therefore would not qualify for honours. Dividing 35 by 3 cohorts (years) means that in a given year approximately 12 students would move from honours to our specialization stream. Looking ahead, next year this change could affect 19 students who will have completed 60 credits or more and are therefore eligible to apply for honours. However, not all eligible students apply for honours. Based on these estimates, we can expect this change to affect approximately 15 students/year, on average.

Reducing the honours cohort by approximately 15 students each year would lower enrollment in the three small honours seminars and the three theses sections by 5 students each, from 20 students to 15 students per section and will reduce the single combined honours class from 60 to 45. The department believes this will enhance the honours experience for those outstanding students (i.e., higher performing students in smaller classes).

This does not rule out students with strong, but lower GPAs (i.e., B+), from completing a thesis that may be a requirement for graduate school. Many of these students pursue graduate or professional training in Psychology and in allied fields (e.g., Education, Social Work). Those students with a GPA below 3.7 have the option to complete a thesis in the specialization stream.

With respect to the change in GPA for the specialization stream, our motivation is to maintain the quality of the specialization experience. Based on the GPAs of current specialization students (N=741), 79 students have a GPA between 3.0 and 3.19 (10.6%). Dividing by 3, this means that approximately 27 students in a given cohort would not be admitted to this stream, and instead would complete their degree in the psychology major stream. Looking ahead, next year this change could affect 34 students who will have completed 60 credits or more and are eligible for the specialization stream and optional thesis. The two specialization thesis sections currently have an enrolment of 31 students and thus there is room for the students not admitted to honours. Our additional GPA change for entry into the specialization stream will ensure there is space in these thesis sections for all students who wish to complete a thesis. With approximately 15 students moved to specialization from honours, the net movement of specialization students to the major stream is estimated at 12 to 19 per year, or 15, on average.

Note that all changes proposed would apply to new students accepted in the 2021-22 academic year and beyond. All current students in the program would remain at the current GPA requirements (3.0 for specialization, 3.5 for honours).

In sum, the proposed GPA changes will benefit our strongest students (A- and higher for honours) and maintain a high quality research experience for those specialization students who want it.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **PSYC-18** VERSION: 2

PROGRAM CHANGE: GPA entry requirement

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: September 2021

Faculty/School: Arts and Science
Department: Psychology
Program: Honours, Specialization in Psychology
Degree: BA, BSc
Calendar Section/Graduate Page Number: 31.250

Type of Change:

[ ] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar	**Proposed Text**
Programs The Department of Psychology offers minor, major, specialization, and honours programs. Both BA and BSc degrees are offered, and students may also choose a Behavioural Neuroscience option for these degrees. Students planning a career or graduate studies in psychology are normally expected to follow the appropriate honours or specialization program. Students planning to pursue graduate studies in clinical psychology should ensure that the course electives they choose coincide with requirements of the licensing boards. The major program is designed for students who wish to concentrate their studies in psychology but at the same time wish to pursue general education in other disciplines. The major program can be combined with a major in another department. Students registered in the Honours, Specialization, or Major in Psychology may select Psychology electives in various Content Areas in order to obtain a broad overview of the discipline. The five Content Areas within the Department are Social, Personality, and Culture; Developmental; Clinical and Health; Behavioural Neuroscience; and Cognitive Science. It is possible for students to pursue in-depth studies within these specific Content Areas by taking Tier 2 courses. The minor program can be taken only by students registered in another degree program and provides the opportunity to gain basic exposure to the main sub-disciplines of psychology or to pursue one such area in some depth. Students are strongly encouraged to take advantage of academic counselling services available in the Department of Psychology in order to select the program and courses that best meet their needs. Students are ultimately responsible for satisfying their particular degree requirements. *The superscript indicates credit value.* *Students seeking admission to ~~the~~ honours program may apply either for direct entry on the University application form or, once in the program, to the departmental honours advisor normally following the completion of 30 credits. Students must have a GPA of ~~3.5~~ in Psychology courses to qualify for entry to the honours and must maintain this GPA to remain within the program.* *To qualify for entry into ~~the~~ specialization program, students must have a GPA of ~~3.0~~ in*	**Programs** The Department of Psychology offers minor, major, specialization, and honours programs. Both BA and BSc degrees are offered, and students may also choose a Behavioural Neuroscience option for these degrees. Students planning a career or graduate studies in psychology are normally expected to follow the appropriate honours or specialization program. Students planning to pursue graduate studies in clinical psychology should ensure that the course electives they choose coincide with requirements of the licensing boards. The major program is designed for students who wish to concentrate their studies in psychology but at the same time wish to pursue general education in other disciplines. The major program can be combined with a major in another department. Students registered in the Honours, Specialization, or Major in Psychology may select Psychology electives in various Content Areas in order to obtain a broad overview of the discipline. The five Content Areas within the Department are Social, Personality, and Culture; Developmental; Clinical and Health; Behavioural Neuroscience; and Cognitive Science. It is possible for students to pursue in-depth studies within these specific Content Areas by taking Tier 2 courses. The minor program can be taken only by students registered in another degree program and provides the opportunity to gain basic exposure to the main sub-disciplines of psychology or to pursue one such area in some depth. Students are strongly encouraged to take advantage of academic counselling services available in the Department of Psychology in order to select the program and courses that best meet their needs. Students are ultimately responsible for satisfying their particular degree requirements. *The superscript indicates credit value.* *Students seeking admission to an honours program may apply either for direct entry on the University application form or, once in the program, to the departmental honours advisor normally following the completion of 30 credits. Students must have a GPA of 3.7 in Psychology courses to qualify for entry to the honours and must maintain this GPA to remain within the program.* *To qualify for entry into a specialization program, students must have a GPA of 3.2 in*

Psychology courses and must maintain this GPA to remain within the program. For additional information concerning programs and courses, students should consult the Department.	*Psychology courses and must maintain this GPA to remain within the program.* For additional information concerning programs and courses, students should consult the Department.

Rationale:

By aligning the GPA entry point with an A- letter grade, the Department would be admitting those students with "outstanding" performance across 30 credits of psychology courses. In effect, this change will bring the number of students enrolled in the honors seminars down to around 16 per seminar (from the current 20 per section). The department believes this will enhance the honours experience for those outstanding students (i.e., higher performing students in smaller classes). This does not rule out students with lower GPAs from completing a thesis that is the requirement for graduate school. Those students with a GPA below 3.7 would be able to complete a thesis in the specialization in Psychology, as the department offers two sections of this course per year.

With respect to the specialization stream, the change will bring the calendar in line with current internal policy/practice of the department.

All changes proposed would apply to new students accepted in the 2021-22 academic year and beyond. All current students in the program would remain at the current GPA requirements (3.0 for specialization, 3.5 for honours).

Resource Implications:

None.

INTERNAL MEMORANDUM

TO: Dr. Sandra Gabriele, Vice- Provost, Innovation in Teaching and Learning

FROM: Dr. M. Debbabi, Interim Dean; Chair, GCS Council

DATE: August 26, 2020

RE: Changes to the undergraduate programs in the ELEC Department

Please find attached the curriculum changes for the undergraduate programs in the Department of Electrical and Computer Engineering. There is no resource implication required for this proposal. A summary of changes is listed as follows.

ELECTRICAL PROGRAM

Electrical Engineering	Amount of credits required		Type of Change
	current	new	
Program core	62.50	70	• Add COEN 313[1] and ELEC 366[2] * • Add a lab component to COEN 243[3]
Options	Various depending on the option enrolled	0	• Delete all options*
Program electives	27	19.50	• Update required credits in response to the changes made in the program core and options

[1.] Digital Systems Design II (3.50 credits)
[2.] Telecommunication Networks (3.50 credit)
[3.] Programming Methodology I (from 3 to 3.50 credit)

*Students who chose not to enroll in an option in which case they must completed COEN 313 and ELEC 366 in the General Stream. Due to the removal of all options, those two courses are included as part of the program core. By deleting the options, students will have more flexibility in choosing electives in various domains and exploring many different fields rather than focusing on one specific area that might limit their career options.

Changes made to the program electives:

Group Title		Changes made to the list
current	new	
Communications and Signal Processing	Telecommunication Networks and Signal Processing	• Remove ELEC 441[1] and ELEC 463[2] • Remove lab component in ELEC 442[3]

Group Title		Changes made to the list
current	**new**	
Electronics/VLSI	Microdevices, Electronics and VLSI	• Renumber COEN 315[4] to COEN 415 • Remove COEN 413[5] • Add ELEC 441[1]
Power	Power and Renewable Energy Systems	---
Control Systems and Avionics	Controls, Robotics and Avionics	• Add COEN 422[7]
Waves and Electromagnetics	---	---
Computer Systems	---	• Remove COEN 313[7], 352[8], 422[6] and SOEN 342[9], 343[10] • Renumber COEN 345 to COEN 448[11] • Add COEN 413[5]
Biological and Biomedical Engineering	---	---
Other	---	---

1. Modern Analog Filter Design (3.50 credits)
2. Telecommunication Networks (3.50 credit)
3. Digital Signal Processing (from 3.50 to 3 credits)
4. Digital Electronics (3.50 credit)
5. Hardware Functional Verification (3 credits)
6. Cyber-Physical Systems (3 credits)
7. Digital Systems Design II (3.50 credits)
8. Data Structures and Algorithms (3 credits)
9. Software Requirements and Specifications (3 credits)
10. Software Architecture and Design I (3 credits)
11. Software Testing and Validation (3.50 credits)

COMPUTER PROGRAM

Computer Engineering	Amount of credits required		Type of Change
	current	**new**	
Program core	72	72.50	• Add a lab component to COEN 243[1]
Options electives	17.5	17	• Update required credits in response to the changes made in the program core

1. Programming Methodology I (from 3 to 3.50 credit)

Changes made to the options:

Option Electives	Type of Change
Avionics and Embedded Systems	• Delete option from the program
Biological and Biomedical Engineering	• Move the option core courses to its list of electives
Pervasive Computing	• Move the option core courses to its list of electives

General Stream	• Renumber COEN 345 to COEN 448[1]

[1.] Software Testing and Validation (3.50 credits)

Changes made to the program electives:

Group Title		Changes made to the list
current	**new**	
Hardware/Electronics/VLSI	---	• Renumber COEN 315[1] to COEN 415
Real-Time and Software Systems	Software and System Design	• Renumber COEN 315[1] to COEN 415 • Remove COEN 424[2] • Add SOEN 321[3], 342[4], 343[5], 344[6], 357[7], 448[8]
Biological and Biomedical Engineering	---	---
Computer Science and Software Engineering	Computer Science and Programming	• Add COEN 424[9] and 432[10] • Remove 321[3], 342[4], 343[5], 344[6], 357[7], 448[8]
Telecommunications, Networks and Signal Processing	Telecommunication Networks and Signal Processing	• Remove lab component in ELEC 442[11]
Control Systems	Controls, Robotics and Avionics	• Combine the list of electives
Avionics		
Other	---	---

[1.] Digital Electronics (3.50 credit)
[2.] Programming on the Cloud (3 credits)
[3.] Information Systems Security (3 credits)
[4.] Software Requirements and Specifications (3 credit)
[5.] Software Architecture and Design I (3 credits)
[6.] Software Architecture and Design II (3 credits)
[7.] User Interface Design (3 credits)
[8.] Management of Evolving Systems (3 credits)
[9.] Programming on the Cloud (3 credits)
[10.] Applied Evolutionary and Learning Algorithms (3 credits)
[11.] Digital Signal Processing (3 credits)

OTHER CHANGES

Course Number		Type of Change					
current	**new**	**credits**		**prerequisite**	**description**	**lab/tut**	**note**
		current	**new**				
COEN 243*	---	3	3.5		x	Add lab	
COEN 315	COEN 415	3.5	---		x		x
COEN 345	COEN 448	3.5	---		x		x
COEN 445*	COEN 366	3.5	---		x		x
COEN 446	---	3	---	x	x		
COEN 447	---	3	---	x	x		
ELEC 242	---	3	---		x		

Course Number		Type of Change					
current	new	credits		prerequisite	description	lab/tut	note
		current	new				
ELEC 342	---	3.5	---		x		
ELEC 442*	---	3.5	3		x	Remove lab	
ELEC 445	---	3	---	x			
ELEC 463	ELEC 366	3.5	---		x		x
ELEC 465	---	3.5	---	x	x		
ELEC 472	---	3.5	---	x	x		

*Corresponding changes have been made to Option C of Aerospace Engineering program in dossier mech-119. With respect to COEN 243 that is listed under the Certificate in Science and Technology (§71.20.9), the credit value will be updated in a proposal and submitted before the deadline for track A.

This proposal was approved by the Engineering and Computer Science Undergraduate Studies Committee (ECSUSC) on April 22, 2020 and by the GCS Council on May 4, 2020. I would be grateful if you could put it on the agenda of the next APC meeting.

INTERNAL MEMORANDUM

DATE: April 14, 2020

TO: Dr. A. Akgunduz, Associate Dean, Academic Programs Faculty of Engineering and Computer Science

FROM: Dr. Shahin Hashtrudi Zad, Associate Chair, Undergraduate Studies, Department of Electrical and Computer Engineering

SUBJECT: Undergraduate Curriculum Changes 2021

Please find enclosed the curriculum package Dossier #118 for the undergraduate programs submitted by the Department of Electrical and Computer Engineering.

These changes have been approved at the Department Undergraduate Studies Committee meeting held on January 24, and February 21, 2020 and at the Department Council meeting held on April 3, 2020. I would be grateful if you could put this on the agenda of the next Engineering and Computer Science Undergraduate Studies Committee meeting.

Overview of Program Changes

Electrical Engineering

Students in Electrical Engineering program can select one of the four options and if a student does not select an option, he/she must follow the general stream of Electrical Engineering program. Based on the statistics most of the students are not taking these options and they enroll in the general stream. Therefore, the department has decided to remove the options and make the general stream as the only choice for students. However, students allow to take 19.5 credits of elective courses from the long list of elective courses from different fields of Electrical Engineering which will allow them to get a flavor of more specialized disciplines. As a result, students will not miss out pedagogically. In fact, students in the general stream receive a better grounding in electrical engineering.

Computer Engineering

Students in Computer Engineering program can select one of the three options and if a student does not select an option, he/she must follow the general stream of Computer Engineering program. Based on the statistics most of the students are not taking these options and they enroll in the general stream. Thus, the department would like to remove all options except for the Pervasive Computing option and the Biological & Biomedical Engineering option and make the general stream as the only choice for students. But since the Pervasive Computing option and the Biological & Biomedical Engineering option are relatively new, the department has therefore decided to keep these options for a few more years and re-visit this decision later.

The Pervasive Computing option of Computer Engineering program has two core courses which are COEN 421 and COEN 424. In recent years, the department has developed two new courses in the same field which are COEN 446 and COEN 422. Therefore, the department has decided that students taking this option may take at least two courses out of the above four courses (COEN 421, 424, 446 and 422) as option core.

The Biological and Biomedical Engineering option of Computer Engineering program has two core courses which are ELEC 444 and COEN 433. In recent years, the department has developed two new courses in the same field which are ELEC 445 and COEN 434. Therefore, the department has decided that students taking this option may take at least two courses out of the above four courses (ELEC 444, COEN 433, ELEC 445 and COEN 434) as option core.

Overview of Course Changes:

- A laboratory is added to COEN 243 course and therefore the credit of this course is increased to 3.5 credits. The reason for the addition of a laboratory is for improving learning of students in this important course. This course is a core course in both programs.

- COEN 315 and COEN 345 are both elective courses. Therefore, the course numbers of these courses have been changed to 400-level (COEN 415 and COEN 448) to indicate that these courses are elective courses.

- Courses COEN 445 and ELEC 463 both belong to the core of one of the programs in the department. Therefore, the course numbers of these courses have been changed to 300-level (COEN 366 and ELEC 366) to indicate that these courses are core courses.

- Courses ELEC 242, ELEC 342 and ELEC 442 is a set of courses about Signals & Systems and Digital Signal Processing. The description of these courses is modified to reflect current material being taught in these courses. Matlab simulation is added to ELEC 242 and since the laboratory was not required for ELEC 442, the credit of this course is reduced to 3 credits.

- For course ELEC 445, the pre-requisite is changed to ELEC 342 since the material in ELEC 342 is enough for teaching ELEC 445.

- Elective courses COEN 446, COEN 447, ELEC 463 and ELEC 472 have as pre-requisite at least one of the courses COEN 445 or ELEC 463. The pre-requisites of these courses are modified due to change of the course number of course explained in the above.

Overview of Course Changes

Item	Rationale	Resource Implications	Course Number	Course Deletion	Change of Title	Credit Value	Description	Note	Prerequisite
COEN 243	Lab has been added to help students practice and develop the programming and problem-solving skills.	The existing computer labs (and TA's) are required.				x	x		
COEN 315	Course number is changed to COEN 415, since this course is an elective and is offered to fourth year students.	None	x				x	x	
COEN 345	Course number is changed to COEN 448, since this course is an elective and is offered to fourth year students.	None	x				x	x	
COEN 445	The course number is changed to COEN 366, since this course is in the core of COEN program and is offered to third year students.	None	x				x	x	
COEN 446	Prerequisite is modified as a result of course number changes proposed for COEN 445 & ELEC 463.	None					x		x
COEN 447	Prerequisite is modified as a result of course number changes proposed for COEN 445 & ELEC 463.	None					x		x
ELEC 242	The software MATLAB is used in several engineering courses. ELEC 242 is a suitable point in the programs to introduce MATLAB. Other changes are clarification of topics covered in this course.	None					x		
ELEC 342	The course description is changed to reflect current material being taught in the course.	None					x		
ELEC 442	Course description is changed to reflect current material being taught in the course. Matlab lab is removed since there is more emphasis on Matlab in prerequisites ELEC 242 and ELEC 342	None				x	x		
ELEC 445	Prerequisite is changed to ELEC 342 since it covers all the background material required for ELEC 445.	None							x
ELEC 463	The course number is changed to ELEC 366, since this course is in the core of E*LEC* program and is offered to third year students.	None	x				x	x	
ELEC 465	Course description is changed to reflect current material being taught. Prerequisite is modified due to changes in the course number of telecom courses.	None					x		x
ELEC 472	Course description of the course is modified to reflect the state-of-the-art in the field of telecommunication networks. Prerequisite is modified due to changes in the course number of telecom courses	None					x		x

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

PROGRAM CHANGE: Electrical Engineering

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering,
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.30.1

Type of Change:
[ ] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar

71.30.1 Course Requirements (BEng in Electrical Engineering)

The program in Electrical Engineering consists of the Engineering Core, the Electrical Engineering Core, and ~~one of five choices as set out below.~~ The ~~normal~~ length of the program is 120 credits.
Students in the Electrical Engineering program are required to complete at least one work term administered by either the CIADI (§71.10.9) or co-op (§71.10.8) offices. Only work terms undertaken after successfully completing 75 credits in the Electrical Engineering program, including ELEC 390, would satisfy this requirement.
In order to fulfill the work term, students must successfully complete one of the courses managed through CIADI or the Institute for Co-operative Education.
It should be noted that ultimately it is the responsibility of the student to find an approved work-term placement.
For information on co-op fees, see concordia.ca/academics/co-op/students/fees.

Engineering Core (30.5 credits)
See §71.20.5.

Electrical Engineering Core		*Credits*
COEN 212	Digital Systems Design I	3.50
COEN 231	Introduction to Discrete Mathematics	3.00
COEN 243	Programming Methodology I	~~3.00~~
COEN 244	Programming Methodology II	3.00
COEN 311	Computer Organization and Software	3.50
COEN 352	Data Structures and Algorithms	3.00

Proposed Text

71.30.1 Course Requirements (BEng in Electrical Engineering)

The program in Electrical Engineering consists of the Engineering Core, the Electrical Engineering Core, and Electives. The minimum length of the program is 120 credits.
Students in the Electrical Engineering program are required to complete at least one work term administered by either the CIADI (§71.10.9) or co-op (§71.10.8) offices. Only work terms undertaken after successfully completing 75 credits in the Electrical Engineering program, including ELEC 390, would satisfy this requirement.
In order to fulfill the work term, students must successfully complete one of the courses managed through CIADI or the Institute for Co-operative Education.
It should be noted that ultimately it is the responsibility of the student to find an approved work-term placement.
For information on co-op fees, see concordia.ca/academics/co-op/students/fees.

Engineering Core (30.5 credits)
See §71.20.5.

Electrical Engineering Core		*Credits*
COEN 212	Digital Systems Design I	3.50
COEN 231	Introduction to Discrete Mathematics	3.00
COEN 243	Programming Methodology I	3.50
COEN 244	Programming Methodology II	3.00
COEN 311	Computer Organization and Software	3.50
COEN 313	Digital Systems Design II	3.50
COEN 352	Data Structures and Algorithms	3.00

ELEC 242	Continuous-Time Signals and Systems	3.00
ELEC 251	Fundamentals of Applied Electromagnetics	3.00
ELEC 311	Electronics I	3.50
ELEC 312	Electronics II	3.50
ELEC 321	Introduction to Semiconductor Materials and Devices	3.50
ELEC 331	Fundamentals of Electrical Power Engineering	3.50
ELEC 342	Discrete-Time Signals and Systems	3.50
ELEC 351	Electromagnetic Waves and Guiding Structures	3.00
ELEC 367	Introduction to Digital Communications	3.50
ELEC 372	Fundamentals of Control Systems	3.50
ELEC 390	Electrical Engineering Product Design Project	3.00
ELEC 490	Capstone Electrical Engineering Design Project*	4.00
ENGR 290	Introductory Engineering Team Design Project	3.00
		———
		~~62.50~~

*Note: Students may replace ELEC 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

~~**Students may choose one of the following options:**~~

~~I. Electronics/VLSI Option~~

~~II. Telecommunications Option~~

~~III. Power and Renewable Energy Option~~

~~IV. Avionics and Control Option~~

~~Otherwise, students must follow V.~~

~~**I. Electronics/VLSI Option**~~ ~~*Credits*~~

ELEC 242	Continuous-Time Signals and Systems	3.00
ELEC 251	Fundamentals of Applied Electromagnetics	3.00
ELEC 311	Electronics I	3.50
ELEC 312	Electronics II	3.50
ELEC 321	Introduction to Semiconductor Materials and Devices	3.50
ELEC 331	Fundamentals of Electrical Power Engineering	3.50
ELEC 342	Discrete-Time Signals and Systems	3.50
ELEC 351	Electromagnetic Waves and Guiding Structures	3.00
ELEC 366	Telecommunication Networks	3.50
ELEC 367	Introduction to Digital Communications	3.50
ELEC 372	Fundamentals of Control Systems	3.50
ELEC 390	Electrical Engineering Product Design Project	3.00
ELEC 490	Capstone Electrical Engineering Design Project*	4.00
ENGR 290	Introductory Engineering Team Design Project	3.00
		———
		70.00

*Note: Students may replace ELEC 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Electrical Engineering Electives

Students must complete at least 19.50 credits from the Electrical Engineering Electives list below. Courses are listed in groups to facilitate course selection. With adequate academic justification and with permission of the Department, students may take one technical elective course from the Computer Engineering Electives list.

A. Telecommunication Networks and Signal Processing		*Credits*
COEN 446	Internet of Things	3.00

~~COEN 315~~	~~Digital Electronics~~	~~3.50~~
~~COEN 451~~	~~VLSI Circuit Design~~	~~4.00~~
	~~Minimum number of Elective credits:~~	~~19.50~~
	~~at least 7.5 of these 19.5 credits must be taken from the Electronics/VLSI Option Electives list. The rest may be chosen from the Electrical Engineering Electives list.~~	
		~~---------~~
		~~27.00~~

~~**Electronics/VLSI Option Electives**~~		~~*Credits*~~
~~COEN 313~~	~~Digital Systems Design II~~	~~3.50~~
~~COEN 413~~	~~Hardware Functional Verification~~	~~3.00~~
~~ELEC 413~~	~~Mixed-Signal VLSI for Communication Systems~~	~~4.00~~
~~ELEC 421~~	~~Solid State Devices~~	~~3.50~~
~~ELEC 422~~	~~Design of Integrated Circuit Components~~	~~3.50~~
~~ELEC 423~~	~~Introduction to Analog VLSI~~	~~4.00~~
~~ELEC 424~~	~~VLSI Process Technology~~	~~3.50~~
~~ELEC 425~~	~~Optical Devices for High-Speed Communications~~	~~3.50~~
~~ELEC 433~~	~~Power Electronics~~	~~3.50~~
~~ELEC 441~~	~~Modern Analog Filter Design~~	~~3.50~~
~~ELEC 442~~	~~Digital Signal Processing~~	~~3.50~~

~~**II. Telecommunications Option**~~		~~*Credits*~~
~~ELEC 463~~	~~Telecommunication Networks~~	~~3.50~~

COEN 447	Software-Defined Networking	3.00
ELEC 442	Digital Signal Processing	3.00
ELEC 464	Wireless Communications	3.00
ELEC 465	Networks Security and Management	3.50
ELEC 466	Introduction to Optical Communication Systems	3.50
ELEC 470	Broadcast Signal Transmission	3.00
ELEC 472	Advanced Telecommunication Networks	3.50

B. Microdevices, Electronics and VLSI		*Credits*
COEN 415	Digital Electronics	3.50
COEN 451	VLSI Circuit Design	4.00
ELEC 413	Mixed-Signal VLSI for Communication Systems	4.00
ELEC 421	Solid State Devices	3.50
ELEC 422	Design of Integrated Circuit Components	3.50
ELEC 423	Introduction to Analog VLSI	4.00
ELEC 424	VLSI Process Technology	3.50
ELEC 425	Optical Devices for High-Speed Communications	3.50
ELEC 441	Modern Analog Filter Design	3.50

C. Power and Renewable Energy Systems		*Credits*
ELEC 430	Electrical Power Equipment*	3.50
ELEC 431	Electrical Power Systems	3.50
ELEC 432	Control of Electrical Power Conversion Systems*	3.50
ELEC 433	Power Electronics	3.50

~~ELEC 464~~	~~Wireless Communications~~	~~3.00~~
	~~Minimum number of Elective credits: at least 9 of these 20.5 credits must be taken from the Telecommunications Option Electives list. The rest may be chosen from the Electrical Engineering Electives list.~~	~~20.50~~
		~~---------~~
		~~27.00~~

~~**Telecommunications Option Electives**~~		~~*Credits*~~
~~COEN 446~~	~~Internet of Things~~	~~3.00~~
~~COEN 447~~	~~Software-Defined Networking~~	~~3.00~~
~~ELEC 413~~	~~Mixed-Signal VLSI for Communication Systems~~	~~4.00~~
~~ELEC 425~~	~~Optical Devices for High-Speed Communications~~	~~3.50~~
~~ELEC 442~~	~~Digital Signal Processing~~	~~3.50~~
~~ELEC 453~~	~~Microwave Engineering~~	~~3.50~~
~~ELEC 456~~	~~Antennas~~	~~3.50~~
~~ELEC 457~~	~~Design of Wireless RF Systems~~	~~3.00~~
~~ELEC 465~~	~~Networks Security and Management~~	~~3.50~~
~~ELEC 466~~	~~Introduction to Optical Communication Systems~~	~~3.50~~
~~ELEC 470~~	~~Broadcast Signal Transmission~~	~~3.00~~
~~ELEC 472~~	~~Advanced Telecommunication Networks~~	~~3.50~~

~~**III. Power and Renewable Energy Option**~~		~~*Credits*~~
~~ELEC 433~~	~~Power Electronics~~	~~3.50~~
~~ELEC 437~~	~~Renewable Energy Systems~~	~~3.00~~

ELEC 434	Behaviour of Power Systems*	3.50
ELEC 435	Electromechanical Energy Conversion Systems	3.50
ELEC 436	Protection of Power Systems*	3.50
ELEC 437	Renewable Energy Systems	3.00
ELEC 438	Industrial Electrical Systems*	3.50
ELEC 439	Hybrid Electric Vehicle Power System Design and Control	3.00
ELEC 440	Controlled Electric Drives	3.50
ELEC 443	Electric Power Distribution Networks*	3.00
ELEC 446	Electrical Power Generation	3.00

*Note: ELEC 430, 432, 434, 436, 438 and 443 are usually offered in the French language.

D. Controls, Robotics and Avionics		*Credits*
AERO 417	Standards, Regulations, and Certification	3.00
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
AERO 483	Integration of Avionics Systems	3.00
COEN 422	Cyber-Physical Systems	3.00
ELEC 473	Autonomy for Mobile Robots	3.00
ELEC 481	Linear Systems	3.50
ELEC 482	System Optimization	3.50
ELEC 483	Real-Time Computer Control Systems	3.50
ENGR 472	Robot Manipulators	3.50

E. Waves and Electromagnetics		*Credits*

~~ELEC 440~~	~~Controlled Electric Drives~~	~~3.50~~
~~ELEC 481~~	~~Linear Systems~~	~~3.50~~
	~~Minimum number of Elective credits: at least 3 of these 13.5 credits must be taken from the Power and Renewable Energy Option Electives list. The rest may be chosen from the Electrical Engineering Electives list.~~	~~13.50~~
		~~---------~~
		~~27.00~~

~~**Power and Renewable Energy Option Electives**~~		~~*Credits*~~
~~ELEC 430~~	~~Electrical Power Equipment*~~	~~3.50~~
~~ELEC 431~~	~~Electrical Power Systems~~	~~3.50~~
~~ELEC 432~~	~~Control of Electrical Power Conversion Systems*~~	~~3.50~~
~~ELEC 434~~	~~Behaviour of Power Systems*~~	~~3.50~~
~~ELEC 435~~	~~Electromechanical Energy Conversion Systems~~	~~3.50~~
~~ELEC 436~~	~~Protection of Power Systems*~~	~~3.50~~
~~ELEC 438~~	~~Industrial Electrical Systems*~~	~~3.50~~
~~ELEC 439~~	~~Hybrid Electric Vehicle Power System Design and Control~~	~~3.00~~
~~ELEC 442~~	~~Digital Signal Processing~~	~~3.50~~
~~ELEC 443~~	~~Electric Power Distribution Networks*~~	~~3.00~~
~~ELEC 446~~	~~Electrical Power Generation~~	~~3.00~~
~~ELEC 482~~	~~System Optimization~~	~~3.50~~
~~ELEC 483~~	~~Real-Time Computer Control Systems~~	~~3.50~~

ELEC 453	Microwave Engineering	3.50
ELEC 455	Acoustics	3.00
ELEC 456	Antennas	3.50
ELEC 457	Design of Wireless RF Systems	3.00
ELEC 458	Techniques in Electromagnetic Compatibility	3.00

F. Computer Systems		*Credits*
COEN 316	Computer Architecture and Design	3.50
COEN 317	Microprocessor Systems	3.50
COEN 320	Introduction to Real-Time Systems	3.00
COEN 346	Operating Systems	3.50
COEN 413	Hardware Functional Verification	3.50
COEN 421	Embedded Systems Design	4.00
COEN 424	Programming on the Cloud	3.00
COEN 448	Software Testing and Validation	3.50
SOEN 341	Software Process	3.00

G. Biological and Biomedical Engineering		*Credits*
COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 433	Biological Computing and Synthetic Biology	3.00
COEN 434	Microfluidic Devices for Synthetic Biology	3.00
ELEC 444	Medical Image Processing	3.00
ELEC 445	Biological Signal Processing	3.00

*Note: ELEC 430, 432, 434, 436, 438 and 443 are usually offered in the French language.

IV. Avionics and Control Option		*Credits*
AERO 417	Standards, Regulations and Certification	3.00
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
AERO 483	Integration of Avionics Systems	3.00
ELEC 483	Real-Time Computer Control Systems	3.50
	Minimum number of Elective credits: Electives must be chosen from the Electrical Engineering Electives list.	11.00

		27.00

V. For students NOT selecting an option		*Credits*
General Stream		
COEN 313	Digital Systems Design II	3.50
ELEC 463	Telecommunication Networks	3.50
	Minimum number of Elective credits: Electives must be chosen from the Electrical Engineering Electives list.	20.00
		———
		27.00

Electrical Engineering Electives
Courses are listed in groups to facilitate course selection. With adequate

H. Other		*Credits*
ELEC 498	Topics in Electrical Engineering	3.00
ENGR 411	Special Technical Report	1.00

academic justification and with permission of the Department, students may take one technical elective course from the Computer Engineering Electives list.

A. ~~Communications~~ and Signal Processing		*Credits*
COEN 446	Internet of Things	3.00
COEN 447	Software-Defined Networking	3.00
~~ELEC 441~~	~~Modern Analog Filter Design~~	~~3.50~~
ELEC 442	Digital Signal Processing	~~3.50~~
~~ELEC 463~~	~~Telecommunication Networks~~	~~3.50~~
ELEC 464	Wireless Communications	3.00
ELEC 465	Networks Security and Management	3.50
ELEC 466	Introduction to Optical Communication Systems	3.50
ELEC 470	Broadcast Signal Transmission	3.00
ELEC 472	Advanced Telecommunication Networks	3.50

B. ~~Electronics/~~VLSI		*Credits*
COEN ~~315~~	Digital Electronics	3.50
~~COEN 413~~	~~Hardware Functional Verification~~	~~3.00~~
COEN 451	VLSI Circuit Design	4.00
ELEC 413	Mixed-Signal VLSI for Communication Systems	4.00
ELEC 421	Solid State Devices	3.50
ELEC 422	Design of Integrated Circuit Components	3.50
ELEC 423	Introduction to Analog VLSI	4.00
ELEC 424	VLSI Process Technology	3.50
ELEC 425	Optical Devices for High-Speed Communications	3.50

C. Power		*Credits*
ELEC 430	Electrical Power Equipment*	3.50
ELEC 431	Electrical Power Systems	3.50
ELEC 432	Control of Electrical Power Conversion Systems*	3.50
ELEC 433	Power Electronics	3.50
ELEC 434	Behaviour of Power Systems*	3.50
ELEC 435	Electromechanical Energy Conversion Systems	3.50
ELEC 436	Protection of Power Systems*	3.50
ELEC 437	Renewable Energy Systems	3.00
ELEC 438	Industrial Electrical Systems*	3.50
ELEC 439	Hybrid Electric Vehicle Power System Design and Control	3.00
ELEC 440	Controlled Electric Drives	3.50
ELEC 443	Electric Power Distribution Networks*	3.00
ELEC 446	Electrical Power Generation	3.00

*Note: ELEC 430, 432, 434, 436, 438 and 443 are usually offered in the French language.

D. ~~Control Systems~~ and Avionics		*Credits*
AERO 417	Standards, Regulations, and Certification	3.00
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
AERO 483	Integration of Avionics Systems	3.00
ELEC 473	Autonomy for Mobile Robots	3.00
ELEC 481	Linear Systems	3.50

ELEC 482	System Optimization	3.50
ELEC 483	Real-Time Computer Control Systems	3.50
ENGR 472	Robot Manipulators	3.50

E. Waves and Electromagnetics		*Credits*
ELEC 453	Microwave Engineering	3.50
ELEC 455	Acoustics	3.00
ELEC 456	Antennas	3.50
ELEC 457	Design of Wireless RF Systems	3.00
ELEC 458	Techniques in Electromagnetic Compatibility	3.00

F. Computer Systems		*Credits*
~~COEN 313~~	~~Digital Systems Design II~~	~~3.50~~
COEN 316	Computer Architecture and Design	3.50
COEN 317	Microprocessor Systems	3.50
COEN 320	Introduction to Real-Time Systems	3.00
~~COEN 345~~	~~Software Testing and Validation~~	~~3.50~~
COEN 346	Operating Systems	3.50
~~COEN 352~~	~~Data Structures and Algorithms~~	~~3.00~~
COEN 421	Embedded Systems Design	4.00
~~COEN 422~~	~~Cyber-Physical Systems~~	~~3.00~~
COEN 424	Programming on the Cloud	3.00
SOEN 341	Software Process	3.00
~~SOEN 342~~	~~Software Requirements and Specifications~~	~~3.00~~

~~SOEN 343~~	~~Software Architecture and Design I~~	~~3.00~~

G. Biological and Biomedical Engineering		*Credits*
COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 433	Biological Computing and Synthetic Biology	3.00
COEN 434	Microfluidic Devices for Synthetic Biology	3.00
ELEC 444	Medical Image Processing	3.00
ELEC 445	Biological Signal Processing	3.00

H. Other		*Credits*
ELEC 498	Topics in Electrical Engineering	3.00
ENGR 411	Special Technical Report	1.00

Rationale:
The proposed changes are intended to remove all option except the General option which becomes the new Electrical program. These changes will increase the flexibility of students in choosing electives and simplify course scheduling. Graduation statistics show that the General option has been favored by a majority of students.

By deleting the options, students will have more flexibility in choosing electives in various domains and exploring many different fields rather than focusing on one specific area that might limit their career options.

Students who chose not to enroll in an option in which case they must completed COEN 313 and ELEC 366 in the General Stream. Due to the removal of all options, those two courses are included as part of the program core.

Resource Implications:
None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

PROGRAM CHANGE: Computer Engineering

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.30.1

Type of Change:
[ ] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar	**Proposed Text**
71.30.2 Course Requirements (BEng in Computer Engineering) The program in Computer Engineering consists of the Engineering Core, the Computer Engineering Core, and one of ~~four~~ choices as set out below. The ~~norma~~l length of the program is 120 credits. Students in the Computer Engineering program are required to complete at least one work term administered by either the CIADI (§71.10.9) or co-op (§71.10.8) offices. Only work terms undertaken after successfully completing 75 credits in the Computer Engineering program, including COEN 390, would satisfy this requirement. In order to fulfill the work term, students must successfully complete one of the courses managed through CIADI or the Institute for Co-operative Education. It should be noted that ultimately it is the responsibility of the student to find an approved work-term placement. For information on co-op fees, see concordia.ca/academics/co-op/students/fees. **Engineering Core:** (30.5 credits) See §71.20.5.	**71.30.2 Course Requirements (BEng in Computer Engineering)** The program in Computer Engineering consists of the Engineering Core, the Computer Engineering Core, and one of three choices as set out below. The minimum length of the program is 120 credits. Students in the Computer Engineering program are required to complete at least one work term administered by either the CIADI (§71.10.9) or co-op (§71.10.8) offices. Only work terms undertaken after successfully completing 75 credits in the Computer Engineering program, including COEN 390, would satisfy this requirement. In order to fulfill the work term, students must successfully complete one of the courses managed through CIADI or the Institute for Co-operative Education. It should be noted that ultimately it is the responsibility of the student to find an approved work-term placement. For information on co-op fees, see concordia.ca/academics/co-op/students/fees. **Engineering Core:** (30.5 credits) See §71.20.5.

Computer Engineering Core		*Credits*
COEN 212	Digital Systems Design I	3.50
COEN 231	Introduction to Discrete Mathematics	3.00
COEN 243	Programming Methodology I	~~3.00~~
COEN 244	Programming Methodology II	3.00
COEN 311	Computer Organization and Software	3.50
COEN 313	Digital Systems Design II	3.50

Computer Engineering Core		*Credits*
COEN 212	Digital Systems Design I	3.50
COEN 231	Introduction to Discrete Mathematics	3.00
COEN 243	Programming Methodology I	3.50
COEN 244	Programming Methodology II	3.00
COEN 311	Computer Organization and Software	3.50
COEN 313	Digital Systems Design II	3.50

COEN 316	Computer Architecture and Design	3.50
COEN 317	Microprocessor Systems	3.50
COEN 320	Introduction to Real-Time Systems	3.00
COEN 346	Operating Systems	3.50
COEN 352	Data Structures and Algorithms	3.00
COEN 390	Computer Engineering Product Design Project	3.00
~~COEN 445~~	~~Communication Networks and Protocols~~	~~3.50~~
COEN 490	Capstone Computer Engineering Design Project*	4.00
ELEC 242	Continuous-Time Signals and Systems	3.00
ELEC 311	Electronics I	3.50
ELEC 342	Discrete-Time Signals and Systems	3.50
ELEC 372	Fundamentals of Control Systems	3.50
ENGR 290	Introductory Engineering Team Design Project	3.00
SOEN 341	Software Process	3.00
	Science Electives	6.00
	If a student takes 6.5 credits, the additional 0.5 credits will be counted towards the credits in Computer Engineering Electives list.	--------
		~~72.00~~

*****Note: Students may replace COEN 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Science Electives		*Credits*
BIOL 206	Elementary Genetics	3.00
BIOL 261	Molecular and General Genetics	3.00
BIOL 266	Cell Biology	3.00

COEN 316	Computer Architecture and Design	3.50
COEN 317	Microprocessor Systems	3.50
COEN 320	Introduction to Real-Time Systems	3.00
COEN 346	Operating Systems	3.50
COEN 352	Data Structures and Algorithms	3.00
COEN 366	Communication Networks and Protocols	3.50
COEN 390	Computer Engineering Product Design Project	3.00
COEN 490	Capstone Computer Engineering Design Project*	4.00
ELEC 242	Continuous-Time Signals and Systems	3.00
ELEC 311	Electronics I	3.50
ELEC 342	Discrete-Time Signals and Systems	3.50
ELEC 372	Fundamentals of Control Systems	3.50
ENGR 290	Introductory Engineering Team Design Project	3.00
SOEN 341	Software Process	3.00
	Science Electives	6.00
	If a student takes 6.5 credits of Science Electives, the additional 0.5 credits will be counted towards the credits in Computer Engineering Electives list.	--------
		72.50

*****Note: Students may replace COEN 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Science Electives		*Credits*
BIOL 206	Elementary Genetics	3.00
BIOL 261	Molecular and General Genetics	3.00
BIOL 266	Cell Biology	3.00

CHEM 217	Introductory Analytical Chemistry I	3.00
CHEM 221	Introductory Organic Chemistry I	3.00
ELEC 321	Introduction to Semiconductor Materials and Devices	3.50
MIAE 221	Materials Science	3.00
PHYS 252	Optics	3.00
PHYS 284	Introduction to Astronomy	3.00
PHYS 367	Modern Physics and Relativity	3.00
PHYS 443	Quantitative Human Systems Physiology	3.00
PHYS 445	Principles of Medical Imaging	3.00

Students may choose one of the following options:

I. ~~Avionics and Embedded Systems Option~~
II. Biological and Biomedical Engineering (BME) Option
III. Pervasive Computing Option

Otherwise, students must follow ~~IV.~~

~~**I. Avionics and Embedded Systems Option Core**~~		~~*Credits*~~
~~AERO 480~~	~~Flight Control Systems~~	~~3.50~~
~~AERO 482~~	~~Avionic Navigation Systems~~	~~3.00~~
~~AERO 483~~	~~Integration of Avionics Systems~~	~~3.00~~
~~COEN 421~~	~~Embedded Systems and Software Design~~	~~4.00~~
	~~Minimum number of Elective credits:~~ ~~At least 3 credits must be chosen from the Avionics and Embedded Systems Option Electives list. The remaining credits may be chosen from the Computer Engineering Electives list.~~	~~4.00~~

CHEM 217	Introductory Analytical Chemistry I	3.00
CHEM 221	Introductory Organic Chemistry I	3.00
ELEC 321	Introduction to Semiconductor Materials and Devices	3.50
MIAE 221	Materials Science	3.00
PHYS 252	Optics	3.00
PHYS 284	Introduction to Astronomy	3.00
PHYS 367	Modern Physics and Relativity	3.00
PHYS 443	Quantitative Human Systems Physiology	3.00
PHYS 445	Principles of Medical Imaging	3.00

Students may choose one of the following options:

I. Biological and Biomedical Engineering (BME) Option
II. Pervasive Computing Option

Otherwise, students must follow III.

I. Biological and Biomedical Engineering (BME) Option

		Credits
	Students must complete a minimum of 17.00.credits of electives from the Biological and Biomedical Engineering (BME) Option Electives and the Computer Engineering Electives lists subject to the following rules. At least 15 credits must be taken from the Biological and Biomedical Engineering Option Electives. At least two courses must be chosen from the following four courses: COEN 433, 434, ELEC 444, 445 Not more than one science course (BIOL or PHYS) may be taken.	17.00

		17.50

Avionics and Embedded Systems Option Electives		*Credits*
AERO 417	Standards, Regulations and Certification	3.00
ELEC 483	Real-Time Computer Control Systems	3.50

II. Biological and Biomedical Engineering (BME) Option Core

		Credits
COEN 433	Biological Computing and Synthetic Biology	3.00
ELEC 444	Medical Image Processing	3.00
	Minimum number of Elective credits: At least 9 of these credits must be taken from the Biological and Biomedical Engineering Option Electives list. Not more than one science course (BIOL or PHYS) may be taken.The remaining credits may be chosen from the Computer Engineering Electives list.	11.50
		———
		17.50

Biological and Biomedical Engineering (BME) Option Electives		*Credits*
BIOL 367	Molecular Biology	3.00
COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 434	Microfluidic Devices for Synthetic Biology	3.00
ELEC 442	Digital Signal Processing	3.50

		17.00

Biological and Biomedical Engineering (BME) Option Electives		*Credits*
BIOL 367	Molecular Biology	3.00
COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 433	Biological Computing and Synthetic Biology	3.00
COEN 434	Microfluidic Devices for Synthetic Biology	3.00
ELEC 442	Digital Signal Processing	3.00
ELEC 444	Medical Image Processing	3.00
ELEC 445	Biological Signal Processing	3.00
PHYS 260	Introductory Biophysics	3.00

II. Pervasive Computing Option	*Credits*
Students must complete a minimum of 17.00.credits of electives from the Pervasive Computing Option Electives and the Computer Engineering Electives lists subject to the following rules. At least 15 credits must be taken from the Pervasive Computing Option Electives. At least two courses must be chosen from four courses: COEN 421, 422, 424 and COEN 446.	17.00
	———
	17.00

Pervasive Computing Option Electives		*Credits*
COEN 421	Embedded Systems Design	4.00
COEN 422	Cyber-Physical Systems	3.00

ELEC 445	Biological Signal Processing	3.00
PHYS 260	Introductory Biophysics	3.00

~~III.~~ Pervasive Computing Option ~~Core~~

		Credits
~~COEN 421~~	~~Embedded Systems Design~~	~~4.00~~
~~COEN 424~~	~~Programming on the Cloud~~	~~3.00~~
	~~Minimum number of Elective credits:~~ At least ~~8 of these~~ credits must be taken from the Pervasive Computing Option Electives ~~list.~~ T~~he rest may be chosen from the Computer Engineering Electives list.~~	~~10.50~~
		~~17.50~~

Pervasive Computing Option Electives

		Credits
COEN 422	Cyber-Physical Systems	3.00
COEN 446	Internet of Things	3.00
COEN 447	Software-Defined Networking	3.00
ELEC 367	Introduction to Digital Communications	3.50
ELEC 472	Advanced Telecommunication Networks	3.50
SOEN 321	Information Systems Security	3.00

~~IV~~. For students NOT selecting an option:

General Stream

		Credits
	Total number of Elective credits: At least 3 of these credits must be taken from the	~~17.50~~
COEN 424	Programming on the Cloud	3.00
COEN 446	Internet of Things	3.00
COEN 447	Software-Defined Networking	3.00
ELEC 367	Introduction to Digital Communications	3.50
ELEC 472	Advanced Telecommunication Networks	3.50
SOEN 321	Information Systems Security	3.00

III. For students NOT selecting an option:

General Stream

		Credits
	Total number of Elective credits: At least 3 of these credits must be taken from the General Stream Electives list. The rest may be chosen from the Computer Engineering Electives list.	17.00
		17.00

General Stream Electives

		Credits
COEN 413	Hardware Functional Verification	3.00
COEN 448	Software Testing and Validation	3.50
SOEN 321	Information Systems Security	3.00

Computer Engineering Electives

Courses are listed in groups to facilitate course selection. With adequate academic justification and with permission of the Department, students may take one technical elective course from the Electrical Engineering Electives list.

A. Hardware/Electronics/VLSI

		Credits
COEN 413	Hardware Functional Verification	3.00

General Stream Electives list. The rest may be chosen from the Computer Engineering Electives list.

~~17.50~~

General Stream Electives *Credits*

~~COEN 345~~	~~Software Testing and Validation~~	~~3.50~~
COEN 413	Hardware Functional Verification	3.00
SOEN 321	Information Systems Security	3.00

Computer Engineering Electives
Courses are listed in groups to facilitate course selection. With adequate academic justification and with permission of the Department, students may take one technical elective course from the Electrical Engineering Electives list.

A. Hardware/Electronics/VLSI *Credits*

~~COEN 315~~	~~Digital Electronics~~	~~3.50~~
COEN 413	Hardware Functional Verification	3.00
COEN 451	VLSI Circuit Design	4.00
ELEC 312	Electronics II	3.50
ELEC 413	Mixed-Signal VLSI for Communication Systems	4.00
ELEC 423	Introduction to Analog VLSI	4.00

B. ~~Real-Time and Software Systems~~ *Credits*

~~COEN 345~~	~~Software Testing and Validation~~	~~3.50~~
COEN 421	Embedded Systems Design	4.00
COEN 422	Cyber-Physical Systems	3.00
~~COEN 424~~	~~Programming on the Cloud~~	~~3.00~~
COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 415	Digital Electronics	3.50
COEN 451	VLSI Circuit Design	4.00
ELEC 312	Electronics II	3.50
ELEC 413	Mixed-Signal VLSI for Communication Systems	4.00
ELEC 423	Introduction to Analog VLSI	4.00

B. Software and System Design *Credits*

COEN 421	Embedded Systems Design	4.00
COEN 422	Cyber-Physical Systems	3.00
COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 448	Software Testing and Validation	3.50
SOEN 321	Information Systems Security	3.00
SOEN 342	Software Requirements and Specifications	3.00
SOEN 343	Software Architecture and Design I	3.00
SOEN 344	Software Architecture and Design II	3.00
SOEN 357	User Interface Design	3.00
SOEN 448	Management of Evolving Systems	3.00

C. Biological and Biomedical Engineering *Credits*

COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 433	Biological Computing and Synthetic Biology	3.00
COEN 434	Microfluidic Devices for Synthetic Biology	3.00
ELEC 444	Medical Image Processing	3.00
ELEC 445	Biological Signal Processing	3.00

D. Computer Science and Programming *Credits*

COEN 424	Programming on the Cloud	3.00
COEN 432	Applied Evolutionary and Learning Algorithms	3.00

C. Biological and Biomedical Engineering		*Credits*
COEN 432	Applied Evolutionary and Learning Algorithms	3.00
COEN 433	Biological Computing and Synthetic Biology	3.00
COEN 434	Microfluidic Devices for Synthetic Biology	3.00
ELEC 444	Medical Image Processing	3.00
ELEC 445	Biological Signal Processing	3.00

D. Computer Science and ~~Software Engineering~~		*Credits*
COMP 335	Introduction to Theoretical Computer Science	3.00
COMP 353	Databases	4.00
COMP 371	Computer Graphics	4.00
COMP 426	Multicore Programming	4.00
COMP 428	Parallel Programming	4.00
COMP 442	Compiler Design	4.00
COMP 451	Database Design	4.00
COMP 465	Design and Analysis of Algorithms	3.00
COMP 472	Artificial Intelligence	4.00
COMP 474	Intelligent Systems	4.00
~~SOEN 321~~	~~Information Systems Security~~	~~3.00~~
~~SOEN 342~~	~~Software Requirements and Specifications~~	~~3.00~~
~~SOEN 343~~	~~Software Architecture and Design I~~	~~3.00~~
~~SOEN 344~~	~~Software Architecture and Design II~~	~~3.00~~
~~SOEN 357~~	~~User Interface Design~~	~~3.00~~
~~SOEN 448~~	~~Management of Evolving Systems~~	~~3.00~~

E. Telecommunication~~s,~~ Networks and Signal Processing		*Credits*
COMP 335	Introduction to Theoretical Computer Science	3.00
COMP 353	Databases	4.00
COMP 371	Computer Graphics	4.00
COMP 426	Multicore Programming	4.00
COMP 428	Parallel Programming	4.00
COMP 442	Compiler Design	4.00
COMP 451	Database Design	4.00
COMP 465	Design and Analysis of Algorithms	3.00
COMP 472	Artificial Intelligence	4.00
COMP 474	Intelligent Systems	4.00

E. Telecommunication Networks and Signal Processing		*Credits*
COEN 446	Internet of Things	3.00
COEN 447	Software-Defined Networking	3.00
ELEC 367	Introduction to Digital Communications	3.50
ELEC 442	Digital Signal Processing	3.00
ELEC 465	Networks Security and Management	3.50
ELEC 470	Broadcast Signal Transmission	3.00
ELEC 472	Advanced Telecommunication Networks	3.50

F. Controls, Robotics and Avionics		*Credits*
AERO 417	Standards, Regulations and Certification	3.00
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00

COEN 446	Internet of Things	3.00
COEN 447	Software-Defined Networking	3.00
ELEC 367	Introduction to Digital Communications	3.50
ELEC 442	Digital Signal Processing	~~3.50~~
ELEC 465	Networks Security and Management	3.50
ELEC 470	Broadcast Signal Transmission	3.00
ELEC 472	Advanced Telecommunication Networks	3.50

F. ~~Control Systems~~		*Credits*
ELEC 473	Autonomy for Mobile Robots	3.00
ELEC 481	Linear Systems	3.50
ELEC 482	System Optimization	3.50
ELEC 483	Real-Time Computer Control Systems	3.50
ENGR 472	Robot Manipulators	3.50

~~G. Avionics~~		*~~Credits~~*
~~AERO 417~~	~~Standards, Regulations and Certification~~	~~3.00~~
~~AERO 480~~	~~Flight Control Systems~~	~~3.50~~
~~AERO 482~~	~~Avionic Navigation Systems~~	~~3.00~~
~~AERO 483~~	~~Integration of Avionics Systems~~	~~3.00~~

~~H.~~ Other		*Credits*
COEN 498	Topics in Computer Engineering	3.00
ENGR 411	Special Technical Report	1.00

AERO 483	Integration of Avionics Systems	3.00
ELEC 473	Autonomy for Mobile Robots	3.00
ELEC 481	Linear Systems	3.50
ELEC 482	System Optimization	3.50
ELEC 483	Real-Time Computer Control Systems	3.50
ENGR 472	Robot Manipulators	3.50

G. Other		*Credits*
COEN 498	Topics in Computer Engineering	3.00
ENGR 411	Special Technical Report	1.00

Rationale:
The Avionics and Embedded Systems option is removed since students have not shown interest in it. The changes in Biological and Biomedical Engineering and Pervasive Computing options is to offer more flexibility to students in choosing electives.

Resource Implications:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: COEN 243 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[X] Credit Value	[ ] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[X] Other - Specify: Add lab		

Present Text (from 2020/2021) calendar	**Proposed Text**
COEN 243 *Programming Methodology I* (~~3~~ credits) Prerequisite: MATH 204 (Cegep Mathematics 105). This course is an introduction to ~~computer hardware and software, programming~~ and programming paradigms~~; essential procedural programming languages: key elements; reserved words and identifiers; data types and declarations; statements; arithmetic expressions; different modes of execution~~. The course covers flow control using If-Else and Switch statements, repetition using loops, recursive functions, pointers, references and dynamic data structures and function pointer. The course material also includes Lambda expression, data structures, built-in arrays, template arrays and vectors, n-dimensional vectors, sorting and searching. Students learn object-oriented programming, user-defined classes, class attributes and methods, object creation, use and destruction. Students are also ~~introducted~~ to exception handling and UML class diagrams. Lectures: three hours per week. Tutorial: two hours per week. *NOTE: Students who have received credit for COMP 248, MIAE 215 or MECH 215 may not take this course for credit.*	**COEN 243 *Programming Methodology I*** (3.50 credits) Prerequisite: MATH 204 (Cegep Mathematics 105). This course is an introduction to computers and programming paradigms. Essential topics from procedural programming languages are discussed such as key elements, reserved words and identifiers, data types and declarations, statements, arithmetic expressions, and different modes of execution. The course covers flow control using If-Else and Switch statements, repetition using loops, recursive functions, pointers, references and dynamic data structures and function pointer. The course material also includes Lambda expression, data structures, built-in arrays, template arrays and vectors, n-dimensional vectors, sorting and searching. Students learn object-oriented programming, user-defined classes, class attributes and methods, object creation, use and destruction. Students are also introduced to exception handling and UML class diagrams. Lectures: three hours per week. Tutorial: two hours per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for COMP 248, MIAE 215 or MECH 215 may not take this course for credit.*

Rationale:
Laboratory for COEN 243 is to help students practice and develop the programming and problem-solving skills. Also, these sessions serve as ideal opportunities for them to practice programming in preparation for more advanced programming and non-programming courses in the undergraduate program. Additionally, the hands-on programming experience during the lab time motivates the students to have higher rate of participation and engagement in the course, and consequently perform better in the final exam.

Resource Implications:
The existing computer labs (and TA's) are required. There are no additional resource implications.

Other Programs within which course is listed:

Certificate in Science and Technology
Aerospace Engineering: Option C

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: COEN 315 New Course Number: COEN 415

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[X] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Add note

Present Text (from 2020/2021) calendar	**Proposed Text**
COEN ~~315~~ *Digital Electronics* (3.5 credits) Prerequisite: ELEC 311. Analysis and simulation of basic digital circuit blocks, in particular, CMOS, BiCMOS and ECL technologies.The focus is on the electronics aspect of digital circuits. Combinational and sequential circuit units, including logic gates, flip-flops,signal generators, static and dynamic memories, and interconnections. Performance analysis in terms of switching speeds, power dissipation, noise immunity, fan-in and fan-out. Lectures: three hours per week. Tutorial: one hour per week. Laboratory: 15 hours total.	**COEN 415 *Digital Electronics*** (3.5 credits) Prerequisite: ELEC 311. This course covers analysis and simulation of basic digital circuit blocks, in particular, CMOS, BiCMOS and ECL technologies.The focus is on the electronics aspect of digital circuits. Combinational and sequential circuit units, including logic gates, flip-flops,signal generators, static and dynamic memories, and interconnections are discussed. Other topics include perfomance analysis in terms of switching speeds, power dissipation, noise immunity, and fan-in and fan-out. Lectures: three hours per week. Tutorial: one hour per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for COEN 315 may not take this course for credit.*

Rationale:
Course number is changed to 400 level, since this course is an elective and is offered to fourth year students

Resource Implications:
None

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: COEN 345 New Course Number: COEN 448

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[X] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Add note

Present Text (from 2020/2021) calendar	**Proposed Text**
COEN ~~345~~ *Software Testing and Validation* (3.5 credits) Prerequisite: SOEN 341. Overview of the three phases and deliverables of a project. Validation vs. verification, reviews, ~~walkthrough. Testing: acceptance testing, integration testing, module testing. Writing stubs. Performance testing. Role of formal methods. Code inspection. Defect tracking. Causality analysis. Software Metrics and quality management.~~ Lectures: three hours per week. Tutorial: one hour per week. Laboratory: 15 hours total.	**COEN 448 *Software Testing and Validation*** (3.5 credits) Prerequisite: SOEN 341. This course starts with an overview of the three phases and deliverables of a project, and then discusses validation vs.verification, reviews and walkthrough. Topics also include acceptance testing, integration testing, module testing. The course covers writing stubs, performance testing, the role of formal methods, code inspection, defect tracking and causality analysis. It concludes with software metrics and quality management. Lectures: three hours per week. Tutorial: one hour per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for COEN 345 may not take this course for credit.*

Rationale:
Course number is changed to 400 level, since this course is an elective and is offered to fourth year students.

Resource Implications:
None

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: COEN 445 New Course Number: COEN 366

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[X] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Modify note

Present Text (from 2020/2021) calendar	**Proposed Text**
COEN ~~445~~ *Communication Networks and Protocols* (3.5 credits) Prerequisite: COEN 346. ~~Communications~~ protocols basics, flow control, error detection and error control techniques~~. Network~~ topologies including local area networks (LANs) and wide area networks (WANs)~~. Layered~~ architecture standards (OSI and TCP/IP) ~~and protocols. Internetworking~~.~~ Application~~ and socket programming. Lectures: three hours per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for ELEC 463 may not take this course for credit.*	**COEN 366 *Communication Networks and Protocols*** (3.5 credits) Prerequisite: COEN 346. The main objectives of the course are an introduction to computer networks, architectures, protocols, and their fundamentals. Topics covered in the course include communications protocols basics, flow control, error detection and error control techniques, network topologies including local area networks (LANs) and wide area networks (WANs), layered architecture standards (OSI and TCP/IP), standard protocols, and their fundamentals, application and socket programming. Lectures: three hours per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for ELEC 366, 463 or COEN 445 may not take this course for credit.*

Rationale:
The course number is changed to 300 level, since this course is in the core of COEN program and is offered to third year students.

Update exclusion note because ELEC 463 has renumbered to ELEC 366.

Resource Implications:
None

Other Programs within which course is listed:

Aerospace Engineering: Option C

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: COEN 446 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[X] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
COEN 446 *Internet of Things* (3 credits) Prerequisite: COEN 445 or ELEC 463. ~~From internet and devices to internet of things (IoT), business models and applications including health monitoring and smart cities. Devices and their connection including wireless sensor networks (WSN). Constraints and requirements. Network access protocols, routing protocols (RPL), transport layer and message queuing telemetry transport (MQTT). Constrained application protocol (CoAP) and efficient XML interchange (EXI). Protocol stack and contrast with internet stack. Security threats. Introduction to IoT analytics. Platforms and tools~~. Lectures: three hours per week.	**COEN 446 *Internet of Things*** (3 credits) Prerequisite: COEN 366 or 445 or ELEC 366 or 463. This course covers the essential principles and techniques for the design and applications of IoT. The topics include IoT concepts and its relations to internet and devices; business models and applications including health monitoring and smart cities; devices and their connection including wireless sensor networks (WSN); constraints and requirements; network access protocols; routing protocols (RPL), transport layer and message queuing telemetry transport (MQTT); constrained application protocol (CoAP) and efficient XML interchange (EXI); protocol stack and contrast with internet stack; security threats. Other topics include introduction to IoT analytics; platforms and tools. Lectures: three hours per week.

Rationale:
Prerequisite is modified as a result of course number changes proposed for COEN 445 and ELEC 463.

The description is revised in full sentences.

Resource Implications:
None

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: COEN 447 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[X] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
COEN 447 *Software-Defined Networking* (3 credits) Prerequisite: COEN 317; COEN 445 or ELEC 463. Control and data planes, centralized vs. distributed control. Network operating ~~systems, network function virtualization. Programmable data planes, network processors, programmable switch pipelines. High-level data-plane programming with P4 and data-plane development kit. Software-defined network emulation project.~~ Lectures: three hours per week.	**COEN 447 *Software-Defined Networking*** (3 credits) Prerequisite: COEN 317; COEN 366 or 445 or ELEC366 or 463. This course equips students with an understanding of the principles and techniques underpinning the design of software-defined networks.Topics include control and data planes, centralized vs. distributed control; network operating systems, network function virtualization; programmable data planes, network processors, programmable switch pipelines; high-level data-plane programming with P4 and data-plane development kit. This course includes a software-defined network emulation project. Lectures: three hours per week.

Rationale:
Prerequisite is modified as a result of course number changes proposed for COEN 445 and ELEC 463.

The description is revised in full sentences.

Resource Implications:
None

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: ELEC 242 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
ELEC 242 ***Continuous-Time Signals and Systems*** (3 credits) Prerequisite: ELEC 273; ENGR 213. Continuous-time signals~~.~~ Properties of continuous-time systems. Linear Time Invariant (LTI) systems~~.~~ Impulse response and convolution~~.~~ Systems based on linear constant-coefficient differential equations. Fourier series representation of periodic signals~~.~~ The Fourier transform representation of signals and systems~~.~~ Inverse Fourier transform~~. Laplace Transform. Inverse Laplace Transform. Unilateral Laplace Transform~~. ~~Natural and forced responses of linear~~ differential equations~~.~~ Transfer function and block diagram representation of LTI systems~~.~~ Time and frequency domain characteristics of ideal and non-ideal filters. ~~Amplitude modulation and demodulation.~~ Lectures: three hours per week. Tutorial: two hours per week. *NOTE: Students who have received credit for ELEC 264 may not take this course for cre*	**ELEC 242** ***Continuous-Time Signals and Systems*** (3 credits) Prerequisite: ELEC 273; ENGR 213. This course covers continuous-time signals and systems theory including properties of continuous-time system, linear time-invariant (LTI) systems, impulse response and convolution and systems based on linear constant-coefficient differential equations. The following transforms are introduced: Fourier series representation of periodic signals, the Fourier transform representation of signals and systems, the inverse Fourier transform, bilateral Laplace transform, unilateral Laplace transform and inverse Laplace transform. Other topics include zero-state and zero-input responses of linear constant-coefficient differential equation models, transfer function and block diagram representation of LTI systems, and time and frequency domain characteristics of ideal and non-ideal filters. Computer simulation using MATLAB is also introduced. Lectures: three hours per week. Tutorial: two hours per week. *NOTE: Students who have received credit for ELEC 264 may not take this course for credit*

Rationale:
The software MATLAB is used in several engineering courses. ELEC242 is a suitable point in the programs to introduce MATLAB.Other changes are clarification of topics covered in this course.

Resource Implications:
None

Other Programs within which course is listed:

Aerospace Engineering: Option C

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: ELEC 342 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
ELEC 342 ***Discrete-Time Signals and Systems*** (3.5 credits) Prerequisite: ELEC 242 or 264. ~~Discrete vs. continuous-time signals. Properties of discrete-time systems. Linear Time Invariant (LTI) systems. Unit impulse response and convolution. Systems based on linear constant-coefficient difference equations. Discrete Fourier series. The Fourier transform representation of signals and systems. Inverse Fourier transform. Sampling of continuous-time signals. Reconstruction of a signal from its samples. Discrete-time processing of continuous-time signals. Quantization. The Z-Transform and inverse Z-Transform. Unilateral Z-Transform. Transfer function and block diagram representation of LTI systems. Basic structures for Finite-Impulse-Response and Infinite-Impulse-Response filters. Computer-based MATLAB simulation~~. Lectures: three hours per week. Tutorial: one hour per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for ELEC 364 may not take this course for credit.*	**ELEC 342** ***Discrete-Time Signals and Systems*** (3.5 credits) Prerequisite: ELEC 242 or 264. Basic material includes discrete vs. continuous-time signals,discrete-time signals, elementary signals and signal operations, discrete-time systems, properties of discrete-time systems and interconnections of systems. Time-domain analysis of discrete-time systems is covered including finite difference equation representation of systems,linear time-invariant (LTI) systems, unit impulse response and convolution, sliding tape method for convolution, periodic convolution, properties of convolution, and properties of LTI systems. The next area is Fourier domain analysis including Discrete-Time Fourier Series (DTFS), Discrete-Time Fourier Transform (DTFT), properties of DTFS and DTFT, frequency response of LTI systems, and continuous and discrete-time Fourier transforms. Conversion of continuous-time to discrete-time signals is covered including ideal impulse train sampling, the sampling theorem, effect of sampling in the frequency and time domains graphically and algebraically, anti-aliasing pre-filter, reconstruction of band limited signal from its samples, discrete-time processing of continuous-time signals, quantization, uniform quantization, quantization noise, granular versus overload noise, and design of uniform quantizers. The Discrete Fourier Transform (DFT) is developed along with the relationship between the DFT and the DTFT. Also covered is the relationship between the DFT and the Fast Fourier Transform (FFT). The z-transform (ZT) is covered with topics including properties, poles and zeros of rational ZTs, inverse and unilateral z-transforms (UZT), Region of Convergence (ROC), and relationship between ZT and DTFT. Filtering topics include LTI systems as frequency-selective filters, ideal filters, Finite Impulse Response (FIR) vs. Infinite Impulse Response (IIR) filters, linear phase FIR filters, filter specification, and designing filters with MATLAB. The course closes with FIR filter design with windowing. Lectures: three hours per week. Tutorial: one hour per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for ELEC 364 may not take this course for credit.*

Rationale:
The course description is changed to reflect current material being taught in the course.

Resource Implications: None
Other Programs within which course is listed: Aerospace Engineering: Option C

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: ELEC 442 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number [ ] Course Title [X] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Remove lab

Present Text (from 2020/2021) calendar	**Proposed Text**
ELEC 442 ***Digital Signal Processing*** ~~(3.5~~ credits) Prerequisite: ELEC 342 or 364; ENGR 371. ~~Review of Z-transform; linear phase and non-linear phase systems; all-pass and minimum phase systems~~, ~~recursive and non-recursive digital filters; common digital filter structures, common design approaches for digital filters; description of typical Digital Signal Processor chips; Review of sampling, reconstruction, interpolation and decimation; changing the sampling rate by integer and non-integer factor; multirate signal processing, polyphase decomposition, multirate filter banks; digital processing of analog signals, A/D and D/A converters; discrete Fourier transform; random signals, Least-Mean-Square (LMS) filters.~~ Lectures: three hours per week. ~~Laboratory: 15 hours total.~~	**ELEC 442** ***Digital Signal Processing*** (3 credits) Prerequisite: ELEC 342 or 364; ENGR 371. The course covers transform analysis of linear time-invariant (LTI) systems involving inverse systems, all-pass and minimum phase systems, and linear-phase finite impulse response (FIR) systems. Implementation of discrete-time LTI systems including structures for FIR and IIR (infinite impulse response) filters, finite word length effects and quantization of filter coefficients is also covered. The topic of digital filter design, i.e., FIR filter design with window and optimization methods and IIR filter design by impulse invariance, bilinear transformation, and frequency transformation is introduced. Also introduced is the multirate signal processing covering decimation and interpolation of discrete-time signals, polyphase structures and filter banks. The course also deals with discrete Fourier transform (DFT), including the properties and computations of DFT, the sampling of discrete-time Fourier transform, linear convolution using DFT and Fourier analysis of signals using DFT. The course closes with random signal processing basics, covering random processes and signals, mean and covariance, correlation and power spectral density, and stationary signal passing through LTI systems. Lectures: three hours per week.

Rationale:
The course description is changed to reflect current material being taught in the course. Matlab based laboratory is removed, since there is more emphasis on Mathlab in ELEC242 and ELEC342 which are taken before ELEC442.

The laboratory component is removed. Hence, its credit value is reduced by 0.5 (from 3.5 to 3).

Resource Implications:
None

Other Programs within which course is listed:

Aerospace Engineering: Option C

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: ELEC 445 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [X] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
ELEC 445 *Biological Signal Processing* (3 credits) Prerequisite: ELEC ~~442~~.This course covers signal processing through discussion of current bioengineering activities which rely on signal processing and include assessment of neural function with simultaneous collection of electroencephalogram (EEG) and functional MRI data; the non-invasive assessment of cardiac autonomic regulation using electrocardiography; assessment of neural function using near-infrared spectroscopy (NIRS); assessment of muscle activity using electromyography (EMG). Topics include modern spectral analysis, time-frequency analysis (short-time Fourier transforms and wavelets); signal modelling; multivariate analyses and adaptive filtering. Lectures: three hours per week. *NOTE: Students who have received credit for this topic under an ELEC 498 number may not take this course for credit.*	**ELEC 445 *Biological Signal Processing*** (3 credits) Prerequisite: ELEC 342. This course covers signal processing through discussion of current bioengineering activities which rely on signal processing and include assessment of neural function with simultaneous collection of electroencephalogram (EEG) and functional MRI data; the non-invasive assessment of cardiac autonomic regulation using electrocardiography; assessment of neural function using near-infrared spectroscopy (NIRS); assessment of muscle activity using electromyography (EMG). Topics include modern spectral analysis, time-frequency analysis (short-time Fourier transforms and wavelets); signal modelling; multivariate analyses and adaptive filtering. Lectures: three hours per week. *NOTE: Students who have received credit for this topic under an ELEC 498 number may not take this course for credit.*

Rationale:
Prerequisite is changed to ELEC 342 since ELEC 342 covers all the background material required for ELEC 445.

Resource Implications:
None

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: ELEC 463 New Course Number: ELEC 366

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[X] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Modify note

Present Text (from 2020/2021) calendar	**Proposed Text**
ELEC ~~463~~ *Telecommunication Networks* (3.5 credits) Prerequisite: COEN 352; ELEC 342 or 364; ENGR 371. This course covers the following topics: communication networks and services; introduction to layered network architectures; transmission systems and the telephone network, including multiplexing,circuit switches, routing and signalling; peer-to-peer protocols including ARQ protocols, data-link controls, packet multiplexing;multiple access communications including Aloha, CSMA, reservation schemes, polling, token-passing ring, LAN standards, LAN ~~bridges; packet-switching networks including datagrams and virtual circuits; TCP/IP architecture including Internet protocol,transmission control protocol~~. Lectures: three hours per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for COEN 445 may not take this course for credit.*	**ELEC 366 *Telecommunication Networks*** (3.5 credits) Prerequisite: COEN 352; ELEC 342 or 364; ENGR 371. The course introduces communication network functions/services and the circuit and packet-switching approaches for network design. It covers transmission systems, multiplexing, switches, signaling and traffic control in circuit-switched networks including cellular networks. It introduces the layered network architecture for packet-switching: peer-to-peer ARQ protocols and data-link controls;TCP/IP architecture: Internet and transport protocols. It covers multiple access communications: Aloha, CSMA, reservation schemes, polling, token passing rings, wireless LANs and LAN bridges. It includes application and socket programming. Lectures: three hours per week. Laboratory: 15 hours total. *NOTE: Students who have received credit for COEN 366 or 445 or ELEC 463 may not take this course for credit.*

Rationale:
The course description is changed to reflect current material being taught in the course. Since this course has become part of the core of Electrical Engineering program, the course number is changed to 300 level. The course is part of the sequence of 3rd year.

Update exclusion note because COEN 445 has renumbered to COEN 366.

Resource Implications:
None

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: ELEC 465 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[X] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
ELEC 465 ***Networks Security and Management*** (3.5 credits) Prerequisite: COEN 445 or ELEC 463. Network security threats. Importance of security policy. Principles and techniques of encryption and authentication. Network security protocols: X509, IPSEC (Internet Protocol Security Architecture). Network management: issues, architectures, and protocols. Fault management, configuration management, security management, performance management, and accounting management. Management Information Bases (MIBs). SNMP and its evolution. Lectures: three hours per week. Laboratory: 15 hours total.	**ELEC 465** ***Networks Security and Management*** (3.5 credits) Prerequisite: COEN 366 or 445 or ELEC 366 or 463. This course covers two important areas of communication networks: network security and network management. In network security, topics include basic cryptography, authentication, message integrity, firewalls, security protocols, virtual private networks (VPNs), and security in wireless LANs. In network management, topics include network management architectures, ASN.1, Management Information Bases (MIBs), SNMP and its evolution. Lectures: three hours per week. Laboratory: 15 hours total.

Rationale:
The course description is changed to reflect current material being taught in the course. Pre-requisite is modified due to changes in the course numbers of COEN 445 and ELEC 463.

Resource Implications:
None

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **ELEC-118** VERSION: 5

COURSE CHANGE: ELEC 472 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Electrical and Computer Engineering
Program: Electrical Engineering, Computer Engineering
Degree: B.Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[X] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
ELEC 472 ***Advanced Telecommunication Networks*** (3.5 credits) Prerequisite: ~~ELEC 463~~ or ~~COEN 445.~~Routing in packet networks, shortest-path algorithms, Internet routing protocols, ATM ~~networks: ATM and ATM adaptation layers, traffic management and QoS, congestion control, ATM signalling, advanced network architectures: classical IP over ATM, MPLS, integrated and differentiated services, mobile communications: wireless transmission,medium access control, GSM system, mobile IP, mobile transport layer and support for mobility.~~ Lectures: three hours per week. Laboratory: 15 hours total.	**ELEC 472** ***Advanced Telecommunication Networks*** (3.5 credits) Prerequisite: COEN 366 or 445 or ELEC 366 or 463. This course covers Internet that has moved beyond the three "classical" services of Email, File transfer and Remote Login to providing real time multimedia communication. The course provides the basic building blocks for the students to understand the current capabilities and potential of high speed Internet to support emerging Internet services. Review of Internet architecture will be followed by quality of service (QoS) requirements and protocols such as differentiated services, integrated services, Resource reservation protocol (RSVP), and Multi protocol label switching (MPLS) to support QoS. Topics also include protocols and standards for voice over IP; H.323, Session Initiation Protocol (SIP) and Media Gateway Control Protocol (MGCP); and their interworking Lectures: three hours per week. Laboratory: 15 hours total.

Rationale:
The description of the course is modified to reflect state-of-the-art in the field of telecommunication networks. Pre-requisite is modified due to changes in the course numbers of COEN 445 and ELEC 463.

Resource Implications:
None

Other Programs within which course is listed:

None

INTERNAL MEMORANDUM

TO: Dr. Sandra Gabriele, Vice- Provost, Innovation in Teaching and Learning

FROM: Dr. M. Debbabi, Interim Dean; Chair, GCS Council

DATE: August 26, 2020

RE: Changes to the undergraduate programs in the MIAE Department

Please find attached the curriculum changes for the undergraduate programs in the Department of Mechanical, Industrial and Aerospace Engineering. There is no resource implication required for this proposal. A summary of changes is listed as follows.

MECHANICAL ENGINEERING PROGRAM

Mechanical Engineering	Amount of credits required		Type of Change
	current	new	
Program core	81.25	81.50	• Take the lab component out from MIAE 311[1] and introduce it as a separate course MIAE 312[2]
Program elective	11.75	11.50	• Update required credits in response to the changes made in the program core

[1.] Manufacturing Processes (from 3.75 to 3 credits)
[2.] Engineering Design and Manufacturing Laboratory (1 credit)

Changes made to the courses listed under electives:

- Update the course description of MECH 447 (Fundamentals of Vehicle System Design) and remove its laboratory component. Hence, its credit value is reduced by 0.5 (from 3.5 to 3).
- Delete MECH 448 (Vehicle Dynamics).
- Renumber MECH 462 (Wind Turbine Engineering) to MECH 468 and update its course description and exclusion note.

Other changes:

- Add MECH 468 to the exclusion note of AERO 462 (Turbomachinery and Propulsion) because students who have received credit for MECH 462 may not take AERO 462 for credit.

INDUSTRIAL ENGINEERING PROGRAM

Industrial Engineering	Amount of credits required		Type of Change
	current	new	
Program core	81.75	82	• Take the lab component out from MIAE 311[1] and introduce it as a separate course MIAE 312[2]
Program elective	11.25	11	• Update required credits in response to the changes made in the program core

[1.] Manufacturing Processes (from 3.75 to 3 credits)
[2.] Engineering Design and Manufacturing Laboratory (1 credit)

Changes made to the courses listed under Basic and Natural Science Courses:

- Add CIVI 231 (Geology for Civil Engineers).
- Replace PHYS 270 (Introduction to Energy and Environment) with PHYS 273 (Energy and Environment) because the course is no longer offer.

Changes made to the courses listed under Electives:

- Divide the list of electives into two categories (INDU Courses and Other Elective Courses).
- Remove MECH 371 (Analysis and Design of Control Systems).

AEROSPACE ENGINEERING PROGRAM

Aerospace Engineering		Amount of credits required		Type of Change
		current	new	
Program Core		36.25	---	---
Option A	Option core	50.25	---	---
	Option elective	6.50	---	---
Option B	Option core	54	54.25	• Take the lab component out from MIAE 311[1] and introduce it as a separate course MIAE 312[2]
	Option elective	2.75	2.50	• Update required credits in response to the changes made in the option core
Option C*	Option core	41.50	42	• Add lab component to COEN 243[3]
	Option elective	15.25	14.75	• Update required credits in response to the changes made in the option core

[1.] Manufacturing Processes (from 3.75 to 3 credits)
[2.] Engineering Design and Manufacturing Laboratory (1 credit)
[3.] Programming Methodology I (from 3 to 3.5 credits)

Changes made to the courses listed under electives of option C*:

- Renumber COEN 445 to COEN 366 (Communication Networks and Protocols).
- Remove the laboratory component in ELEC 442 (Digital Signal Processing). Hence, its credit value is reduced by 0.5 (from 3.5 to 3).

*The changes made in option C corresponds to the changes proposed in dossier elec-118.

This proposal was approved by the Engineering and Computer Science Undergraduate Studies Committee (ECSUSC) on April 22, 2020 and by the GCS Council on May 4, 2020. I would be grateful if you could put it on the agenda of the next APC meeting.

Université Concordia University
GINA CODY SCHOOL OF ENGINEERING AND COMPUTER SCIENCE
Department of Mechanical, Industrial & Aerospace Engineering

INTERNAL MEMORANDUM

DATE: April 14, 2020

TO: Dr. A. Akgunduz, Associate Dean, Academic Programs
Faculty of Engineering and Computer Science

FROM: Dr. Martin Pugh, Chair,
Department of Mechanical, Industrial and Aerospace Engineering

SUBJECT: **Undergraduate Changes 2021-22**

Please find enclosed the Undergraduate curriculum package, MECH-119, submitted by the Department of Mechanical, Industrial and Aerospace Engineering (MIAE). These changes have been approved at the Department Council meeting held on April 3rd, 2020.

I would be grateful if you could put this on the agenda of the next Engineering and Computer Science Undergraduate Studies Committee meeting.

1455 De Maisonneuve Blvd. W., EV-4.139, Montreal, Quebec, Canada H3G 1M8
Tel. 514-848-2424 ext. 3175 concordia.ca/ginacody

Overview of Program Changes:

Type of Changes	Details and/or Rationale	Resource Implications
Mechanical Engineering **ACTION(S):** • Editorial	• MECH 462 Wind Turbine Engineering, has been renumbered to MECH 468 Wind Turbine Engineering for Electives of Design and Manufacturing, as well as that of Thermo-Fluids and Propulsion. • MECH 448 has been removed from our course offerings. • MIAE 311 Manufacturing Processes has changed from 3.75 to 3.00 credits and MIAE 312 Engineering Design and Manufacturing Laboratory has been added to the program core for 1.00 credits. • The Program core credits have increased to 81.50 and the Elective credit requirements have decreased to 11.50 due to the MIAE 311 and 312 changes.	There are no additional resource implications.
Industrial Engineering **ACTION(S):** • Editorial • Requirements	• PHYS 270, Introduction to Energy and Environment, has been replaced by PHYS 273, Energy and Environment under the Basic and Natural Sciences. • MECH 371 has been removed as an elective. • MIAE 311 Manufacturing Processes has changed from 3.75 to 3.00 credits and MIAE 312 Engineering Design and Manufacturing Laboratory has been added to the program core for 1.00 credits. • The Program core credits have increased to 82 and the Elective credit requirements have decreased to 11 due to the MIAE 311 and 312 changes. • Technical Elective requirements have been updated to clearly show that students are required to take 3 INDU courses. • Addition of CIVI 231, Geology for Civil Engineers, to the list of Basic and Natural Sciences. This course is already included in the list of Basic and Natural Science for SOEN students, and it will give more options to our students. It is also more beneficial to students who change concentration from Civil to INDU.	There are no additional resource implications.

Type of Changes	Details and/or Rationale	Resource Implications
Aerospace Engineering **ACTION(S):** • Editorial • Requirements	Changes to Option B: • MIAE 311 Manufacturing Processes has changed from 3.75 to 3.00 credits and MIAE 312 Engineering Design and Manufacturing Laboratory has been added to the program core for 1.00 credits. • The B core credits have increased to 54.25 and the Elective credit requirements have decreased to 2.50 due to the MIAE 311 and 312 changes. • The * notation has been removed from various courses as students no longer take more than 1 technical elective course. Changes to Option C (as per the Electrical and Computer Engineering proposals; ELEC117 and ELEC118) • Credit value of COEN 243 increased to 3.50, increasing the AERO C core to 42 credits and decreasing the AERO C elective requirements to 14.75 credits. • Credit value of ELEC 442 reduced to 3.00 • Course number of COEN 445 changed to COEN 366	There are no additional resource implications.

Overview of Course Changes:

Type of Changes	Rationale	Resource Implications
MECH 462 *Wind Turbine Engineering* **ACTION(S):** • Course Description (update exclusion note)	Students who have received credit for MECH 462 may not take AERO 462 for credit. Since MECH 462 has been renumbered to MECH 468, the exclusion note of AERO 462 needs to be updated accordingly.	There are no additional resource implications.
MECH 447 *Fundamentals of Vehicle System Design* **ACTION(S):** • Course Description • Credit Value	Course contents are updated to include some aspects of dynamic responses of vehicles to road and steering inputs, which are presently addressed in MECH448 (to be deleted from the program) Current laboratory experiments involve 2 simulation exercises using CarSim software and a relatively elementary steering system hardware. It is proposed to replace the lab work by home works involving simulation exercises.	There are no additional resource implications.
MECH 448 *Vehicle Dynamics* **ACTION(S):** • Course Deletion	MECH 448 is currently offered together with MECH6751 (paired), and the MEng students dominate the course. This, however, is the second course in the subject area for our undergraduate students; the first one being MECH447. Our undergraduate students thus come with very good background, which is absent among the graduate student. It has thus been a challenge to be fair to students at both the levels.	There are no additional resource implications.
MECH 462 *Wind Turbine Engineering* **ACTION(S):** • Course Number • Update course description to full sentences	MECH 462 used to be the previous course number of AERO 462 and is mentioned in the note following the description of AERO 462. **AERO 462** *Turbomachinery and Propulsion* (3 credits) Prerequisite: MECH 351, 361. Aircraft design process, preliminary sizing and thrust requirements. Rotary and fixed wing aerodynamics and stability. Helicopter configurations. Structure and fatigue design considerations. Review of the gas turbine cycle and components arrangement. Turbo-propulsion: turboprop, turbofan, turbojet and turboshafts. Energy transfer in turbomachines: Euler equation, velocity triangles. Dimensional analysis of	There are no additional resource implications.

Type of Changes	Rationale	Resource Implications
	turbomachines. Flow in turbomachines. Three-dimensional flow in turbomachines. Mechanisms of losses in turbomachines. Axial-flow turbines and compressors. Centrifugal compressors. Compressor and turbine performance maps; surge and stall. Lectures: three hours per week. Tutorial: one hour per week. NOTE: Students who have received credit for MECH 462 may not take this course for credit. We are changing the course number of MECH 462 Wind Turbine Engineering to a unique number to avoid confusion.	
MIAE 311 *Manufacturing Processes* **ACTION(S):** • Course Description • Credit Value	The lab component of MIAE 311 is being split into a new course (MIAE 312 Engineering Design and Manufacturing Laboratory, 1cr). By splitting the labs, it gives us the opportunity to improve the contents and develop further activities that will add value to students' portfolios. It also provides for flexibility in scheduling.	There are no additional resource implications.
MIAE 312 *Engineering Design and Manufacturing Processes Lab* **ACTION(S):** • New Course	By creating a stand-alone lab for MIAE 311 Manufacturing Processes, now 3.00cr, it gives us the opportunity to improve the contents and develop further activities that will add value to students' portfolios. It also provides for flexibility in scheduling.	There are no additional resource implications.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

PROGRAM CHANGE: 71.40.1 Course Requirements (BEng in Mechanical Engineering)

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Mechanical Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.40.1

Type of Change:
[X] Editorial [ ] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar

71.40.1 Course Requirements (BEng in Mechanical Engineering)

The program in Mechanical Engineering consists of the Engineering Core, the Mechanical Engineering Core, and elective credits as shown below. The minimum length of the program is 120 credits.

Engineering Core (27 credits)
See §71.20.5.

Mechanical Engineering Core		*Credits*
ENGR 242	Statics	3.00
ENGR 243	Dynamics	3.00
ENGR 244	Mechanics of Materials	3.75
ENGR 251	Thermodynamics I	3.00
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
ENGR 361	Fluid Mechanics I	3.00
MECH 321	Properties and Failure of Materials	3.50
MECH 343	Theory of Machines	3.50
MECH 344	Machine Element Design	3.00
MECH 351	Thermodynamics II	3.50
MECH 352	Heat Transfer I	3.50
MECH 361	Fluid Mechanics II	3.50
MECH 368	Electronics for Mechanical Engineers	3.50
MECH 370	Modelling and Analysis of Dynamic Systems	3.50
MECH 371	Analysis and Design of Control Systems	3.75
MECH 375	Mechanical Vibrations	3.50

Proposed Text

71.40.1 Course Requirements (BEng in Mechanical Engineering)

The program in Mechanical Engineering consists of the Engineering Core, the Mechanical Engineering Core, and elective credits as shown below. The minimum length of the program is 120 credits.

Engineering Core (27 credits)
See §71.20.5.

Mechanical Engineering Core		*Credits*
ENGR 242	Statics	3.00
ENGR 243	Dynamics	3.00
ENGR 244	Mechanics of Materials	3.75
ENGR 251	Thermodynamics I	3.00
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
ENGR 361	Fluid Mechanics I	3.00
MECH 321	Properties and Failure of Materials	3.50
MECH 343	Theory of Machines	3.50
MECH 344	Machine Element Design	3.00
MECH 351	Thermodynamics II	3.50
MECH 352	Heat Transfer I	3.50
MECH 361	Fluid Mechanics II	3.50
MECH 368	Electronics for Mechanical Engineers	3.50
MECH 370	Modelling and Analysis of Dynamic Systems	3.50
MECH 371	Analysis and Design of Control Systems	3.75
MECH 375	Mechanical Vibrations	3.50

MECH 390	Mechanical Engineering Design Project	3.50
MECH 490	Capstone Mechanical Engineering Design Project*	4.00
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
MIAE 311	Manufacturing Processes	3.~~75~~
MIAE 313	Machine Drawing and Design	3.50
MIAE 380	Product Design and Development	3.00
		81.~~25~~

*Note: Students may replace MECH 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Electives

Students in the Mechanical Engineering program must complete at least 11.~~75~~ elective credits from the list of courses below. Courses are listed in groups to facilitate the selection of courses in a particular area of the field.

Aerospace		*Credits*
AERO 417	Standards, Regulations and Certification	3.00
AERO 446	Aerospace Vehicle Performance	3.00
AERO 455	Computational Fluid Dynamics for Aerospace Applications	3.75
AERO 462	Turbomachinery and Propulsion	3.00
AERO 464	Aerodynamics	3.00
AERO 465	Gas Turbine Design	3.50
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
AERO 485	Introduction to Space Systems	3.00
AERO 486	Aircraft Stress Analysis	3.00
AERO 487	Design of Aircraft Structures	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 498	Topics in Mechanical Engineering	3.00

Design and Manufacturing		*Credits*
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00

MECH 390	Mechanical Engineering Design Project	3.50
MECH 490	Capstone Mechanical Engineering Design Project*	4.00
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
MIAE 311	Manufacturing Processes	3.00
MIAE 312	Engineering Design and Manufacturing Laboratory	1.00
MIAE 313	Machine Drawing and Design	3.50
MIAE 380	Product Design and Development	3.00
		81.50

*Note: Students may replace MECH 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Electives

Students in the Mechanical Engineering program must complete at least 11.50 elective credits from the list of courses below. Courses are listed in groups to facilitate the selection of courses in a particular area of the field.

Aerospace		*Credits*
AERO 417	Standards, Regulations and Certification	3.00
AERO 446	Aerospace Vehicle Performance	3.00
AERO 455	Computational Fluid Dynamics for Aerospace Applications	3.75
AERO 462	Turbomachinery and Propulsion	3.00
AERO 464	Aerodynamics	3.00
AERO 465	Gas Turbine Design	3.50
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
AERO 485	Introduction to Space Systems	3.00
AERO 486	Aircraft Stress Analysis	3.00
AERO 487	Design of Aircraft Structures	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 498	Topics in Mechanical Engineering	3.00

Design and Manufacturing		*Credits*
ENGR 411	Special Technical Report	1.00

INDU 372	Quality Control and Reliability	3.00
INDU 410	Safety Engineering	3.00
INDU 411	Computer Integrated Manufacturing	3.50
MECH 412	Computer-Aided Mechanical Design	3.50
MECH 414	Computer Numerically Controlled Machining	3.50
MECH 421	Mechanical Shaping of Metals and Plastics	3.50
MECH 422	Mechanical Behaviour of Polymer Composite Materials	3.00
MECH 423	Casting, Welding, Heat Treating, and Non-Destructive Testing	3.50
MECH 424	MEMS – Design and Fabrication	3.50
MECH 425	Manufacturing of Composites	3.50
MECH ~~462~~	Wind Turbine Engineering	3.00
MECH 476	Generative Design and Manufacturing in Engineering	3.00
MECH 498	Topics in Mechanical Engineering	3.00

Systems and Mechatronics		*Credits*
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 411	Instrumentation and Measurements	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 463	Fluid Power Control	3.50
MECH 471	Microcontrollers for Mechatronics	3.50
MECH 472	Mechatronics and Automation	3.50
MECH 473	Control System Design	3.50
MECH 474	Mechatronics	3.75
MECH 498	Topics in Mechanical Engineering	3.00

Thermo-Fluids and Propulsion		*Credits*
AERO 455	Computational Fluid Dynamics for Aerospace Applications	3.75
AERO 462	Turbomachinery and Propulsion	3.00
AERO 465	Gas Turbine Design	3.50
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 411	Instrumentation and Measurements	3.50

ENGR 412	Honours Research Project	3.00
INDU 372	Quality Control and Reliability	3.00
INDU 410	Safety Engineering	3.00
INDU 411	Computer Integrated Manufacturing	3.50
MECH 412	Computer-Aided Mechanical Design	3.50
MECH 414	Computer Numerically Controlled Machining	3.50
MECH 421	Mechanical Shaping of Metals and Plastics	3.50
MECH 422	Mechanical Behaviour of Polymer Composite Materials	3.00
MECH 423	Casting, Welding, Heat Treating, and Non-Destructive Testing	3.50
MECH 424	MEMS – Design and Fabrication	3.50
MECH 425	Manufacturing of Composites	3.50
MECH 468	Wind Turbine Engineering	3.00
MECH 476	Generative Design and Manufacturing in Engineering	3.00
MECH 498	Topics in Mechanical Engineering	3.00

Systems and Mechatronics		*Credits*
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 411	Instrumentation and Measurements	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 463	Fluid Power Control	3.50
MECH 471	Microcontrollers for Mechatronics	3.50
MECH 472	Mechatronics and Automation	3.50
MECH 473	Control System Design	3.50
MECH 474	Mechatronics	3.75
MECH 498	Topics in Mechanical Engineering	3.00

Thermo-Fluids and Propulsion		*Credits*
AERO 455	Computational Fluid Dynamics for Aerospace Applications	3.75
AERO 462	Turbomachinery and Propulsion	3.00
AERO 465	Gas Turbine Design	3.50
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00

MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 452	Heat Transfer II	3.50
MECH 453	Heating, Ventilation and Air Conditioning Systems	3.00
MECH 461	Gas Dynamics	3.50
MECH ~~462~~	Wind Turbine Engineering	3.00
MECH 463	Fluid Power Control	3.50
MECH 498	Topics in Mechanical Engineering	3.00
Vehicle Systems		*Credits*
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 411	Instrumentation and Measurements	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 444	Guided Vehicle Systems	3.00
MECH 447	Fundamentals of Vehicle System Design	~~3.50~~
~~MECH 448~~	~~Vehicle Dynamics~~	~~3.00~~
MECH 454	Vehicular Internal Combustion Engines	3.00
MECH 473	Control System Design	3.50
MECH 498	Topics in Mechanical Engineering	3.00
Stress Analysis		*Credits*
AERO 431	Principles of Aeroelasticity	3.00
AERO 486	Aircraft Stress Analysis	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 411	Instrumentation and Measurements	3.50
MECH 412	Computer-Aided Mechanical Design	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 422	Mechanical Behaviour of Polymer Composite Materials	3.00
MECH 426	Stress and Failure Analysis of Machinery	3.00
MECH 460	Finite Element Analysis	3.75
MECH 498	Topics in Mechanical Engineering	3.00

MECH 411	Instrumentation and Measurements	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 452	Heat Transfer II	3.50
MECH 453	Heating, Ventilation and Air Conditioning Systems	3.00
MECH 461	Gas Dynamics	3.50
MECH 463	Fluid Power Control	3.50
MECH 468	Wind Turbine Engineering	3.00
MECH 498	Topics in Mechanical Engineering	3.00
Vehicle Systems		*Credits*
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 411	Instrumentation and Measurements	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 444	Guided Vehicle Systems	3.00
MECH 447	Fundamentals of Vehicle System Design	3.00
MECH 454	Vehicular Internal Combustion Engines	3.00
MECH 473	Control System Design	3.50
MECH 498	Topics in Mechanical Engineering	3.00
Stress Analysis		*Credits*
AERO 431	Principles of Aeroelasticity	3.00
AERO 486	Aircraft Stress Analysis	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MECH 411	Instrumentation and Measurements	3.50
MECH 412	Computer-Aided Mechanical Design	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 422	Mechanical Behaviour of Polymer Composite Materials	3.00
MECH 426	Stress and Failure Analysis of Machinery	3.00
MECH 460	Finite Element Analysis	3.75
MECH 498	Topics in Mechanical Engineering	3.00

Rationale:

MECH 462 Wind Turbine Engineering, has been renumbered to MECH 468 Wind Turbine Engineering for Electives of Design and Manufacturing, as well as that of Thermo-Fluids and Propulsion.

MECH 448 has been removed from our course offerings.

MIAE 311 Manufacturing Processes has changed from 3.75 to 3.00 credits and MIAE 312 Engineering Design and Manufacturing Laboratory has been added to the program core for 1.00 credits.

The Program core credits have increased to 81.50 and the Elective credit requirements have decreased to 11.50 due to the MIAE 311 and 312 changes.

Resource Implications:
none

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

PROGRAM CHANGE: 71.40.2 Course Requirements (BEng in Industrial Engineering)

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Industrial Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.40.2

Type of Change:
[X] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar

71.40.2 Course Requirements (BEng in Industrial Engineering)

The program in Industrial Engineering consists of the Engineering Core, the Industrial Engineering Core, and elective credits as shown below. Students must select one course from the list of Basic and Natural Science courses as part of the Industrial Engineering Core courses. The minimum length of the program is 120 credits.

Engineering Core (27 credits)
See §71.20.5.

Industrial Engineering Core		*Credits*
ENGR 245	Mechanical Analysis	3.00
ENGR 251	Thermodynamics I	3.00
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
INDU 211	Introduction to Production and Manufacturing Systems	3.00
INDU 311	Simulation of Industrial Systems	3.50
INDU 320	Production Engineering	3.00
INDU 321	Lean Manufacturing	3.00
INDU 323	Operations Research I	3.50
INDU 324	Operations Research II	3.50
INDU 330	Engineering Management	3.00
INDU 342	Logistics Network Models	3.00
INDU 371	Stochastic Models in Industrial Engineering	3.00
INDU 372	Quality Control and Reliability	3.00
INDU 411	Computer Integrated Manufacturing	3.50
INDU 412	Human Factors Engineering	3.50

Proposed Text

71.40.2 Course Requirements (BEng in Industrial Engineering)

The program in Industrial Engineering consists of the Engineering Core, the Industrial Engineering Core, and elective credits as shown below. Students must select one course from the list of Basic and Natural Science courses as part of the Industrial Engineering Core courses. The minimum length of the program is 120 credits.

Engineering Core (27 credits)
See §71.20.5.

Industrial Engineering Core		*Credits*
ENGR 245	Mechanical Analysis	3.00
ENGR 251	Thermodynamics I	3.00
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
INDU 211	Introduction to Production and Manufacturing Systems	3.00
INDU 311	Simulation of Industrial Systems	3.50
INDU 320	Production Engineering	3.00
INDU 321	Lean Manufacturing	3.00
INDU 323	Operations Research I	3.50
INDU 324	Operations Research II	3.50
INDU 330	Engineering Management	3.00
INDU 342	Logistics Network Models	3.00
INDU 371	Stochastic Models in Industrial Engineering	3.00
INDU 372	Quality Control and Reliability	3.00
INDU 411	Computer Integrated Manufacturing	3.50
INDU 412	Human Factors Engineering	3.50

INDU 421	Facilities Design and Material Handling Systems	3.50
INDU 423	Inventory Control	3.50
INDU 490	Capstone Industrial Engineering Design Project*	4.00
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
MIAE 311	Manufacturing Processes	3.~~75~~
MIAE 313	Machine Drawing and Design	3.50
MIAE 380	Product Design and Development	3.00
	One Basic and Natural Science course from the list below.	3.00
		_____
		~~81.75~~

*Note: Students may replace INDU 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Basic and Natural Science Courses

Students must complete one course from the following list:		*Credits*
BIOL 206	Elementary Genetics	3.00
BIOL 261	Molecular and General Genetics	3.00
CHEM 217	Introductory Analytical Chemistry I	3.00
CHEM 221	Introductory Organic Chemistry I	3.00
GEOL 206	Earthquakes, Volcanoes, and Plate Tectonics	3.00
GEOL 208	The Earth, Moon and the Planets	3.00
PHYS 252	Optics	3.00
PHYS 260	Introductory Biophysics	3.00
~~PHYS 270~~	~~Introduction to Energy and Environment~~	~~3.00~~
PHYS 284	Introduction to Astronomy	3.00
PHYS 385	Astrophysics	3.00

Electives

Students must complete a minimum of 11.~~25~~ credits from the following courses, including at least three INDU courses~~ and with no more than one of the courses marked *~~. With permission of the Department, students may take one technical elective course from another program or Faculty.

		Credits
~~BSTA 478*~~	~~Data Mining Techniques~~	~~3.00~~

INDU 421	Facilities Design and Material Handling Systems	3.50
INDU 423	Inventory Control	3.50
INDU 490	Capstone Industrial Engineering Design Project*	4.00
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
MIAE 311	Manufacturing Processes	3.00
MIAE 312	Engineering Design and Manufacturing Laboratory	1.00
MIAE 313	Machine Drawing and Design	3.50
MIAE 380	Product Design and Development	3.00
	One Basic and Natural Science course from the list below.	3.00
		_____
		82.00

*Note: Students may replace INDU 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Basic and Natural Science Courses

Students must complete one course from the following list:		*Credits*
BIOL 206	Elementary Genetics	3.00
BIOL 261	Molecular and General Genetics	3.00
CHEM 217	Introductory Analytical Chemistry I	3.00
CHEM 221	Introductory Organic Chemistry I	3.00
CIVI 231	Geology for Civil Engineers	3.00
GEOL 206	Earthquakes, Volcanoes, and Plate Tectonics	3.00
GEOL 208	The Earth, Moon and the Planets	3.00
PHYS 252	Optics	3.00
PHYS 260	Introductory Biophysics	3.00
PHYS 273	Energy and Environment	3.00
PHYS 284	Introduction to Astronomy	3.00
PHYS 385	Astrophysics	3.00

Electives

Students must complete a minimum of 11 credits from the following courses, including at least three INDU courses. With permission of the Department, students may take one technical elective course from another program or Faculty.

~~BTM 430*~~	~~Enterprise Resource Planning and Information Technology Integration~~	~~3.00~~
~~BTM 480*~~	~~Project Management~~	~~3.00~~
~~ENGR 361~~	~~Fluid Mechanics I~~	~~3.00~~
~~ENGR 411~~	~~Special Technical Report~~	~~1.00~~
~~ENGR 412~~	~~Honours Research Project~~	~~3.00~~
INDU 410	Safety Engineering	3.00
INDU 431	Quantitative Methods in Health-care Systems	3.00
INDU 441	Introduction to Six Sigma	3.00
INDU 466	Decision Models in Service Sector	3.00
INDU 475	Advanced Concepts in Quality Improvement	3.00
INDU 480	Cases in Industrial Engineering	3.00
INDU 498	Topics in Industrial Engineering	3.00
~~MANA 300*~~	~~Entrepreneurship: Launching Your Business~~	~~3.00~~
~~MECH 321~~	~~Properties and Failure of Materials~~	~~3.50~~
~~MECH 370~~	~~Modelling and Analysis of Dynamic Systems~~	~~3.50~~
~~MECH 371~~	~~Analysis and Design of Control Systems~~	~~3.75~~
~~MECH 412~~	~~Computer-Aided Mechanical Design~~	~~3.50~~
~~MECH 415~~	~~Advanced Programming for Mechanical and Industrial Engineers~~	~~3.00~~
~~MECH 421~~	~~Mechanical Shaping of Metals and Plastics~~	~~3.50~~
~~MECH 423~~	~~Casting, Welding, Heat Treating and Non-Destructive Testing~~	~~3.50~~
~~MECH 425~~	~~Manufacturing of Composites~~	~~3.50~~

INDU Courses

Students must take at least three INDU courses from the following list:

		Credits
INDU 410	Safety Engineering	3.00
INDU 431	Quantitative Methods in Health-care Systems	3.00
INDU 441	Introduction to Six Sigma	3.00
INDU 466	Decision Models in Service Sector	3.00
INDU 475	Advanced Concepts in Quality Improvement	3.00
INDU 480	Cases in Industrial Engineering	3.00
INDU 498	Topics in Industrial Engineering	3.00

Other Elective Courses

Students may take no more than one course from the following list:

		Credits
BSTA 478*	Data Mining Techniques	3.00
BTM 430*	Enterprise Resource Planning and Information Technology Integration	3.00
BTM 480*	Project Management	3.00
ENGR 361	Fluid Mechanics I	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
MANA 300*	Entrepreneurship: Launching Your Business	3.00
MECH 321	Properties and Failure of Materials	3.50
MECH 370	Modelling and Analysis of Dynamic Systems	3.50
MECH 412	Computer-Aided Mechanical Design	3.50
MECH 415	Advanced Programming for Mechanical and Industrial Engineers	3.00
MECH 421	Mechanical Shaping of Metals and Plastics	3.50
MECH 423	Casting, Welding, Heat Treating and Non-Destructive Testing	3.50
MECH 425	Manufacturing of Composites	3.50

Rationale:
- Editorial changes to the Technical Elective requirements to clearly indicate that students are required to take 3 INDU courses.
- PHYS 270 has never been offered by the Department of Physics; whereby, it is being replaced by PHYS 273.
- Students may only take 1 non-INDU course. As MECH 371 has MECH 370 as pre-requisite, the students can never take MECH 371.
- MIAE 311 Manufacturing Processes has changed from 3.75 to 3.00 credits and MIAE 312 Engineering Design and Manufacturing Laboratory has been added to the program core for 1.00 credits.
- The Program core credits have increased to 82 and the Elective credit requirements have decreased to 11 due to the MIAE 311 and 312 changes.

Addition of CIVI 231, Geology for Civil Engineers, to the list of Basic and Natural Sciences. This course is already included in the list of Basic and Natural Science for SOEN students,

and it will give more options to our students. It is also more beneficial to students who change concentration from Civil Engineering to Industrial Engineering.

CIVI 231 ***Geology for Civil Engineers*** (3 credits)
Basic principles of physical and structural geology with emphasis on topics related to civil engineering, study of minerals, rocks and soil types, load formation, techniques of air-photo interpretations, and geological mapping. Geological site investigation. Preparation and interpretation of engineering geology reports. Lectures: three hours per week. Tutorial: one hour per week.

Resource Implications:
None

PROGRAM CHANGE: 71.55 Course Requirements (BEng in Aerospace Engineering)

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Aerospace Engienering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.55

Type of Change:
[X] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar

Course Requirements (BEng in Aerospace Engineering)

The program in Aerospace Engineering consists of the Engineering Core, the Aerospace Engineering Core, and option requirements as shown below. The minimum length of the program is 120 credits.

Engineering Core (27 credits)
See §71.20.5.

Aerospace Engineering Core		*Credits*
AERO 201	Introduction to Flight and Aerospace Systems	4.00
AERO 290	Introduction to Aircraft Design	3.00
AERO 371	Modelling and Control Systems	3.50
AERO 390	Aerospace Engineering Design Project	3.00
AERO 417	Standards, Regulations and Certification	3.00
AERO 490	Capstone Aerospace Engineering Design Project*	4.00
ENGR 242	Statics	3.00
ENGR 243	Dynamics	3.00
ENGR 244	Mechanics of Materials	3.75
ENGR 251	Thermodynamics I	3.00
ENGR 361	Fluid Mechanics I	3.00
		36.25

*Note: Students may replace AERO 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Proposed Text

Course Requirements (BEng in Aerospace Engineering)

The program in Aerospace Engineering consists of the Engineering Core, the Aerospace Engineering Core, and option requirements as shown below. The minimum length of the program is 120 credits.

Engineering Core (27 credits)
See §71.20.5.

Aerospace Engineering Core		*Credits*
AERO 201	Introduction to Flight and Aerospace Systems	4.00
AERO 290	Introduction to Aircraft Design	3.00
AERO 371	Modelling and Control Systems	3.50
AERO 390	Aerospace Engineering Design Project	3.00
AERO 417	Standards, Regulations and Certification	3.00
AERO 490	Capstone Aerospace Engineering Design Project*	4.00
ENGR 242	Statics	3.00
ENGR 243	Dynamics	3.00
ENGR 244	Mechanics of Materials	3.75
ENGR 251	Thermodynamics I	3.00
ENGR 361	Fluid Mechanics I	3.00
		36.25

*Note: Students may replace AERO 490 with ENGR 490 if they are interested in a multidisciplinary project that requires collaboration with students from other engineering departments. In order for students to register in ENGR 490, their projects must be approved by the ENGR 490 Design Committee before the start of the fall term.

Option Requirements
Students in the Aerospace Engineering program must complete at least 56.75 elective credits from within one of options A, B, or C.

1. Option A — Aerodynamics and Propulsion
Students must complete the following compulsory courses from the Option Core and at least 6.5 credits from the Option Electives, with no more than one of the courses marked *. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

Option A Core		*Credits*
AERO 446	Aerospace Vehicle Performance	3.00
AERO 455	Computational Fluid Dynamics for Aerospace Applications	3.75
AERO 462	Turbomachinery and Propulsion	3.00
AERO 464	Aerodynamics	3.00
AERO 465	Gas Turbine Design	3.50
AERO 481	Materials Engineering for Aerospace	3.50
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
MECH 343	Theory of Machines	3.50
MECH 351	Thermodynamics II	3.50
MECH 352	Heat Transfer I	3.50
MECH 361	Fluid Mechanics II	3.50
MECH 461	Gas Dynamics	3.50
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
		50.25

Option A Electives		*Credits*
AERO 431	Principles of Aeroelasticity	3.00
AERO 471	Aircraft Hydro-Mechanical and Fuel Systems	3.50
AERO 472	Aircraft Pneumatic and Electrical Power Systems	3.50
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
AERO 485	Introduction to Space Systems	3.00
AERO 486*	Aircraft Stress Analysis	3.00
ENGR 411	Special Technical Report	1.00

Option Requirements
Students in the Aerospace Engineering program must complete at least 56.75 elective credits from within one of options A, B, or C.

1. Option A — Aerodynamics and Propulsion
Students must complete the following compulsory courses from the Option Core and at least 6.5 credits from the Option Electives, with no more than one of the courses marked *. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

Option A Core		*Credits*
AERO 446	Aerospace Vehicle Performance	3.00
AERO 455	Computational Fluid Dynamics for Aerospace Applications	3.75
AERO 462	Turbomachinery and Propulsion	3.00
AERO 464	Aerodynamics	3.00
AERO 465	Gas Turbine Design	3.50
AERO 481	Materials Engineering for Aerospace	3.50
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
MECH 343	Theory of Machines	3.50
MECH 351	Thermodynamics II	3.50
MECH 352	Heat Transfer I	3.50
MECH 361	Fluid Mechanics II	3.50
MECH 461	Gas Dynamics	3.50
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
		50.25

Option A Electives		*Credits*
AERO 431	Principles of Aeroelasticity	3.00
AERO 471	Aircraft Hydro-Mechanical and Fuel Systems	3.50
AERO 472	Aircraft Pneumatic and Electrical Power Systems	3.50
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
AERO 485	Introduction to Space Systems	3.00
AERO 486*	Aircraft Stress Analysis	3.00
ENGR 411	Special Technical Report	1.00

ENGR 412	Honours Research Project	3.00
INDU 372	Quality Control and Reliability	3.00
MECH 368	Electronics for Mechanical Engineers	3.50
MECH 375*	Mechanical Vibrations	3.50
MECH 411	Instrumentation and Measurements	3.50
MECH 426*	Stress and Failure Analysis of Machinery	3.00
MECH 452	Heat Transfer II	3.50
MECH 453	Heating, Ventilation and Air Conditioning Systems	3.00
MECH 460*	Finite Element Analysis	3.75
MECH 498	Topics in Mechanical Engineering	3.00

2. Option B — Aerospace Structures and Materials

Students must complete the following compulsory courses from the Option Core and at least 2.~~75~~ credits from the Option Electives. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

Option B Core		*Credits*
AERO 431	Principles of Aeroelasticity	3.00
AERO 481	Materials Engineering for Aerospace	3.50
AERO 486	Aircraft Stress Analysis	3.00
AERO 487	Design of Aircraft Structures	3.00
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
MECH 343	Theory of Machines	3.50
MECH 352	Heat Transfer I	3.50
MECH 375	Mechanical Vibrations	3.50
MECH 411	Instrumentation and Measurements	3.50
MECH 412	Computer-Aided Mechanical Design	3.50
MECH 460	Finite Element Analysis	3.75
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
MIAE 311	Manufacturing Processes	3.~~75~~
MIAE 313	Machine Drawing and Design	3.50
		_____
		54.~~00~~

Option B Electives		*Credits*
AERO 455~~*~~	Computational Fluid Dynamics for Aerospace Applications	3.75

ENGR 412	Honours Research Project	3.00
INDU 372	Quality Control and Reliability	3.00
MECH 368	Electronics for Mechanical Engineers	3.50
MECH 375*	Mechanical Vibrations	3.50
MECH 411	Instrumentation and Measurements	3.50
MECH 426*	Stress and Failure Analysis of Machinery	3.00
MECH 452	Heat Transfer II	3.50
MECH 453	Heating, Ventilation and Air Conditioning Systems	3.00
MECH 460*	Finite Element Analysis	3.75
MECH 498	Topics in Mechanical Engineering	3.00

2. Option B — Aerospace Structures and Materials

Students must complete the following compulsory courses from the Option Core and at least 2.50 credits from the Option Electives. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

Option B Core		*Credits*
AERO 431	Principles of Aeroelasticity	3.00
AERO 481	Materials Engineering for Aerospace	3.50
AERO 486	Aircraft Stress Analysis	3.00
AERO 487	Design of Aircraft Structures	3.00
ENGR 311	Transform Calculus and Partial Differential Equations	3.00
MECH 343	Theory of Machines	3.50
MECH 352	Heat Transfer I	3.50
MECH 375	Mechanical Vibrations	3.50
MECH 411	Instrumentation and Measurements	3.50
MECH 412	Computer-Aided Mechanical Design	3.50
MECH 460	Finite Element Analysis	3.75
MIAE 211	Mechanical Engineering Drawing	3.50
MIAE 215	Programming for Mechanical and Industrial Engineers	3.50
MIAE 221	Materials Science	3.00
MIAE 311	Manufacturing Processes	3.00
MIAE 312	Engineering Design and Manufacturing Laboratory	1.00
MIAE 313	Machine Drawing and Design	3.50
		_____
		54.25

Option B Electives		*Credits*

AERO 471	Aircraft Hydro-Mechanical and Fuel Systems	3.50
AERO 472	Aircraft Pneumatic and Electrical Power Systems	3.50
AERO 480~~*~~	Flight Control Systems	3.50
AERO 482~~*~~	Avionic Navigation Systems	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
INDU 372	Quality Control and Reliability	3.00
MECH 344	Machine Element Design	3.00
MECH 351~~*~~	Thermodynamics II	3.50
MECH 361~~*~~	Fluid Mechanics II	3.50
MECH 368	Electronics for Mechanical Engineers	3.50
MECH 422	Mechanical Behaviour of Polymer Composite Materials	3.00
MECH 425	Manufacturing of Composites	3.50
MECH 426	Stress and Failure Analysis of Machinery	3.00
MECH 476	Generative Design and Manufacturing in Engineering	3.00
MECH 498	Topics in Mechanical Engineering	3.00

3. Option C — Avionics and Aerospace Systems

Students must complete the following compulsory courses from the Option Core and at least ~~15.25~~ credits from the Option Electives. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

Option C Core		*Credits*
AERO 482	Avionics Navigation Systems	3.00
AERO 483	Integration of Avionics Systems	3.00
COEN 212	Digital Systems Design I	3.50
COEN 231	Introduction to Discrete Mathematics	3.00
COEN 243	Programming Methodology I	3.~~00~~
COEN 244	Programming Methodology II	3.00
COEN 311	Computer Organization and Software	3.50
COEN 352	Data Structures and Algorithms	3.00
ELEC 242	Continuous-Time Signals and Systems	3.00
ELEC 273	Basic Circuit Analysis	3.50
ELEC 342	Discrete-Time Signals and Systems	3.50
ELEC 483	Real-Time Computer Control Systems	3.50
SOEN 341	Software Process and Practices	3.00
		~~41.50~~

AERO 455	Computational Fluid Dynamics for Aerospace Applications	3.75
AERO 471	Aircraft Hydro-Mechanical and Fuel Systems	3.50
AERO 472	Aircraft Pneumatic and Electrical Power Systems	3.50
AERO 480	Flight Control Systems	3.50
AERO 482	Avionic Navigation Systems	3.00
ENGR 411	Special Technical Report	1.00
ENGR 412	Honours Research Project	3.00
INDU 372	Quality Control and Reliability	3.00
MECH 344	Machine Element Design	3.00
MECH 351	Thermodynamics II	3.50
MECH 361	Fluid Mechanics II	3.50
MECH 368	Electronics for Mechanical Engineers	3.50
MECH 422	Mechanical Behaviour of Polymer Composite Materials	3.00
MECH 425	Manufacturing of Composites	3.50
MECH 426	Stress and Failure Analysis of Machinery	3.00
MECH 476	Generative Design and Manufacturing in Engineering	3.00
MECH 498	Topics in Mechanical Engineering	3.00

3. Option C — Avionics and Aerospace Systems

Students must complete the following compulsory courses from the Option Core and at least 14.75 credits from the Option Electives. Students having a GPA of 3.0 or more may submit a request to take a graduate course as an elective.

Option C Core		*Credits*
AERO 482	Avionics Navigation Systems	3.00
AERO 483	Integration of Avionics Systems	3.00
COEN 212	Digital Systems Design I	3.50
COEN 231	Introduction to Discrete Mathematics	3.00
COEN 243	Programming Methodology I	3.50
COEN 244	Programming Methodology II	3.00
COEN 311	Computer Organization and Software	3.50
COEN 352	Data Structures and Algorithms	3.00
ELEC 242	Continuous-Time Signals and Systems	3.00
ELEC 273	Basic Circuit Analysis	3.50
ELEC 342	Discrete-Time Signals and Systems	3.50
ELEC 483	Real-Time Computer Control Systems	3.50
SOEN 341	Software Process and Practices	3.00

Option C Electives		*Credits*
AERO 471	Aircraft Hydro-Mechanical and Fuel Systems	3.50
AERO 472	Aircraft Pneumatic and Electrical Power Systems	3.50
AERO 480	Flight Control Systems	3.50
COEN 313	Digital Systems Design II	3.50
COEN 317	Microprocessor-Based Systems	3.50
COEN 320	Introduction to Real-Time Systems	3.00
COEN 346	Operating Systems	3.50
COEN 413	Hardware Functional Verification	3.00
COEN 421	Embedded Systems Design	4.00
~~COEN 445~~	~~Communication Networks and Protocols~~	~~3.50~~
COEN 498	Topics in Computer Engineering	3.00
ELEC 251	Fundamentals of Applied Electromagnetics	3.00
ELEC 311	Electronics I	3.50
ELEC 331	Fundamentals of Electrical Power Engineering	3.50
ELEC 351	Electromagnetic Waves and Guiding Structures	3.00
ELEC 367	Introduction to Digital Communications	3.50
ELEC 433	Power Electronics	3.50
ELEC 442	Digital Signal Processing	3.~~50~~
ELEC 458	Techniques in Electromagnetic Compatibility	3.00
ELEC 464	Wireless Communications	3.00
ELEC 481	Linear Systems	3.50
ELEC 482	System Optimization	3.50
ELEC 498	Topics in Electrical Engineering	3.00
ENGR 411	Special Technical Report	1.00
SOEN 342	Software Requirements and Deployment	3.00
SOEN 343	Software Architecture and Design	3.00

42.00

Option C Electives		*Credits*
AERO 471	Aircraft Hydro-Mechanical and Fuel Systems	3.50
AERO 472	Aircraft Pneumatic and Electrical Power Systems	3.50
AERO 480	Flight Control Systems	3.50
COEN 313	Digital Systems Design II	3.50
COEN 317	Microprocessor-Based Systems	3.50
COEN 320	Introduction to Real-Time Systems	3.00
COEN 346	Operating Systems	3.50
COEN 366	Communication Networks and Protocols	3.50
COEN 413	Hardware Functional Verification	3.00
COEN 421	Embedded Systems Design	4.00
COEN 498	Topics in Computer Engineering	3.00
ELEC 251	Fundamentals of Applied Electromagnetics	3.00
ELEC 311	Electronics I	3.50
ELEC 331	Fundamentals of Electrical Power Engineering	3.50
ELEC 351	Electromagnetic Waves and Guiding Structures	3.00
ELEC 367	Introduction to Digital Communications	3.50
ELEC 433	Power Electronics	3.50
ELEC 442	Digital Signal Processing	3.00
ELEC 458	Techniques in Electromagnetic Compatibility	3.00
ELEC 464	Wireless Communications	3.00
ELEC 481	Linear Systems	3.50
ELEC 482	System Optimization	3.50
ELEC 498	Topics in Electrical Engineering	3.00
ENGR 411	Special Technical Report	1.00
SOEN 342	Software Requirements and Deployment	3.00
SOEN 343	Software Architecture and Design	3.00

Rationale:
Changes to Option B:
- MIAE 311 Manufacturing Processes has changed from 3.75 to 3.00 credits and MIAE 312 Engineering Design and Manufacturing Laboratory has been added to the program core for 1.00 credits.
- The B core credits have increased to 54.25 and the Elective credit requirements have decreased to 2.50 due to the MIAE 311 and 312 changes.
- The * notation has been removed from various courses as students no longer take more than 1 technical elective course.

Changes to Option C as per the Electrical and Computer Engineering proposal elec-118:
- COEN 243 Programming Methodology I has increased from 3.00 credits to 3.50 credits, making the C core credits increase to 42.00

- Due to the increase in core credits, the Technical Elective requirements for Option C are reduced to 14.75 credits.
- COEN 445 Communication Networks and Protocols has been renumbered to COEN 366
- ELEC 442 Digital Signal Processing credits have dereased from 3.50 to 3.00

Resource Implications:
There are no additional resource implications.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

COURSE CHANGE: AERO 462 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Mechanical Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[ ] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [X] Other - Specify: Update note

Present Text (from 2020/2021) calendar	**Proposed Text**
AERO 462 ***Turbomachinery and Propulsion*** (3 credits) Prerequisite: MECH 351, 361. Aircraft design process, preliminary sizing and thrust requirements. Rotary and fixed wing aerodynamics and stability. Helicopter configurations. Structure and fatigue design considerations. Review of the gas turbine cycle and components arrangement. Turbo-propulsion: turboprop, turbofan, turbojet and turboshafts. Energy transfer in turbomachines: Euler equation, velocity triangles. Dimensional analysis of turbomachines. Flow in turbomachines. Three-dimensional flow in turbomachines. Mechanisms of losses in turbomachines. Axial-flow turbines and compressors. Centrifugal compressors. Compressor and turbine performance maps; surge and stall. Lectures: three hours per week. Tutorial: one hour per week. *NOTE: Students who have received credit for MECH 462 may not take this course for credit.*	**AERO 462** ***Turbomachinery and Propulsion*** (3 credits) Prerequisite: MECH 351, 361. Aircraft design process, preliminary sizing and thrust requirements. Rotary and fixed wing aerodynamics and stability. Helicopter configurations. Structure and fatigue design considerations. Review of the gas turbine cycle and components arrangement. Turbo-propulsion: turboprop, turbofan, turbojet and turboshafts. Energy transfer in turbomachines: Euler equation, velocity triangles. Dimensional analysis of turbomachines. Flow in turbomachines. Three-dimensional flow in turbomachines. Mechanisms of losses in turbomachines. Axial-flow turbines and compressors. Centrifugal compressors. Compressor and turbine performance maps; surge and stall. Lectures: three hours per week. Tutorial: one hour per week. *NOTE: Students who have received credit for MECH 462 or MECH 468 may not take this course for credit.*

Rationale:
The course MECH 462 has been renumberd to MECH 468; thus, the exclusion note of AERO 462 needs to be updated accordingly.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

COURSE CHANGE: MECH 447 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Mechanical Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[X] Credit Value	[ ] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
MECH 447 ***Fundamentals of Vehicle System Design*** (3~~.5~~ credits) Prerequisite: MECH 343. ~~Mechanics and construction~~ of ~~wheels and~~ tires: rolling resistance, tractive and braking forces, ~~brake system design: components of mechanical, hydraulic and pneumatic brake systems, braking efficiency, antilock braking devices,~~ performance characteristics of road vehicles: transmission design, driving condition diagrams, acceleration, speed and stopping distance, gradability, steering mechanisms: design and kinematics~~, suspension spring and shock absorbers: anti-roll and anti-pitch devices, chassis and body design considerations.~~ Lectures: three hours per week. ~~Laboratory: two hours per week, alternate weeks.~~	**MECH 447** ***Fundamentals of Vehicle System Design*** (3 credits) Prerequisite: MECH 343. This course focuses on the fundamental of vehicles system design. The following topics are covered: mechanics of tires such as rolling resistance, tractive and braking forces, cornering and self-aligning properties, and ride properties; performance characteristics of road vehicles such as transmission design, driving condition diagrams, acceleration, speed and stopping distance, gradability, brake system design, braking performance, braking efficiency, antilock braking system; steering mechanisms such as design and kinematics; handling characteristics of vehicles such as steady-state handling analysis, steady-state and transient responses to steering inputs, transient measurement methods, directional stability; vehicle ride; suspension system design and modeling; ride models; case studies using CarSim. Lectures: three hours per week.

Rationale:
Course contents are updated to include some aspects of dynamic responses of vehicles to road and steering inputs, which are presently addressed in MECH 448 (to be deleted from the program.) Current laboratory experiments involve 2 simulation exercises using CarSim software and a relatively elementary steering system hardware. It is proposed to replace the lab work by homework involving simulation exercises.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

COURSE CHANGE: MECH 448 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Mechancial Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[ ] New Course	
[X] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
MECH 448 ***Vehicle Dynamics*** (3 credits) Prerequisite: MECH 447 previously or concurrently. Tire-terrain interactions; side-slip, cornering and aligning properties of tires; camber angle and camber torque; estimation of braking/tractive and cornering forces of tires; steady-state handling of road vehicles; steering response and directional stability; handling and directional response of vehicles with multiple steerable axles; handling of articulated vehicles; handling and directional response of tracked and wheeled off-road vehicles; directional response to simultaneous braking and steering. Lectures: three hours per week.	

Rationale:
MECH 448 is currently offered together with MECH 6751 (paired), and the MEng students dominate the course. However, this is the second course in the subject area for our undergraduate students with the first course being MECH 447. As such, our undergraduate students come with very good background which is absent amongst the graduate students. It has thus been a challenge to be fair to students at both the levels.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

COURSE CHANGE: MECH 462 New Course Number: MECH 468

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Mechanical Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[X] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[X] Other - Specify: Add note		

Present Text (from 2020/2021) calendar	**Proposed Text**
MECH ~~462~~ ***Wind Turbine Engineering*** (3 credits) Prerequisite: MECH 343, 361; MECH 344, 371 previously or concurrently. This course is designed to cover the theoretical and practical areas pertinent to the operation of wind turbines. ~~Energy~~ in the wind~~. Aerodynamic~~ drag and lift of turbine blades~~. Horizontal~~ axis and vertical axis wind turbine designs~~. Generators. Control~~ systems~~. Mechanical~~ load analysis~~:~~ blade, tower, generator and gearbox~~. Blade~~ and tower design~~. Turbine~~ braking~~.~~ ~~Economical~~, environmental and safety aspects.	**MECH 468** ***Wind Turbine Engineering*** (3 credits) Prerequisite: MECH 343, 361; MECH 344, 371 previously or concurrently. This course is designed to cover the theoretical and practical areas pertinent to the operation of wind turbines. The following topics are covered: energy in the wind; aerodynamic drag and lift of turbine blades; horizontal axis and vertical axis wind turbine designs; generators; control systems; mechanical load analysis such as blade, tower, generator and gearbox; blade and tower design; turbine braking; economical, environmental and safety aspects. *NOTE: Students who have received credit for MECH 462 may not take this course for credit*

Rationale:
MECH 462 used to be the previous course number of AERO 462 and is mentioned in the note following the description of AERO 462.

AERO 462 Turbomachinery and Propulsion (3 credits)
Prerequisite: MECH 351, 361. Aircraft design process, preliminary sizing and thrust requirements. Rotary and fixed wing aerodynamics and stability. Helicopter configurations. Structure and fatigue design considerations. Review of the gas turbine cycle and components arrangement. Turbo-propulsion: turboprop, turbofan, turbojet and turboshafts. Energy transfer in turbomachines: Euler equation, velocity triangles. Dimensional analysis of turbomachines. Flow in turbomachines. Three-dimensional flow in turbomachines. Mechanisms of losses in turbomachines. Axial-flow turbines and compressors. Centrifugal compressors. Compressor and turbine performance maps; surge and stall. Lectures: three hours per week. Tutorial: one hour per week. NOTE: Students who have received credit for MECH 462 may not take this course for credit.

We are changing the course number of MECH 462 Wind Turbine Engineering to a unique number to avoid confusion and revising the course description with full sentences.

Resource Implications:
None.

Other Programs within which course is listed:

None.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

COURSE CHANGE: MIAE 311 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Mechanical, Industrial and Aerospace Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[X] Credit Value	[ ] Prerequisite
[X] Course Description	[ ] Editorial	[ ] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
MIAE 311 ***Manufacturing Processes*** (3.~~75~~ credits) Prerequisite: MECH 313 or MIAE 313. This course focuses on the fundamentals of manufacturing processes and their limitations, metrology, machine shop practice, safety and health considerations, forming, conventional machining and casting processes, welding and joining, plastic production, and non-conventional machining techniques; sustainable technologies. Laboratory includes instruction and practice on conventional machine tools and a manufacturing project. Lectures: three hours per week. Tutorial: two hours per week, including industrial visits and field trips to local industries. ~~Laboratory: three hours per week, alternate weeks.~~ *NOTE: Students who have received credit for MECH 311 may not take this course for credit.*	**MIAE 311** ***Manufacturing Processes*** (3.00 credits) Prerequisite: MECH 313 or MIAE 313. This course focuses on the fundamentals of manufacturing processes and their limitations, metrology, machine shop practice, safety and health considerations, forming, conventional machining and casting processes, welding and joining, plastic production, and non-conventional machining techniques; sustainable technologies. Laboratory includes instruction and practice on conventional machine tools and a manufacturing project. Lectures: three hours per week. Tutorial: two hours per week, including industrial visits and field trips to local industries. *NOTE: Students who have received credit for MECH 311 may not take this course for credit.*

Rationale:
The lab component of MIAE 311 is being split into a new course (MIAE 312 Engineering Design and Manufacturing Laboratory, 1cr).
By splitting the labs, it gives us the opportunity to improve the contents and develop further activities that will add value to students' portfolios.
It also provides for flexibility in scheduling.

Resource Implications:
There are no resource implications.

Other Programs within which course is listed:

None

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **MECH-119** VERSION: 5

COURSE CHANGE: MIAE 312 New Course Number:

Proposed [X] Undergraduate or [ ] Graduate Curriculum Changes

Calendar for academic year: 2021/2022
Implementation Month/Year: May 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Mechanical, Industrial and Aerospace Engineering
Program: Mechanical, Industrial and Aerospace Engineering
Degree: B. Eng
Calendar Section/Graduate Page Number: 71.60

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[X] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 2020/2021) calendar	**Proposed Text**
	MIAE 312 ***Engineering Design and Manufacturing Processes Lab*** (1 credit) Prerequisite: MIAE 311 previously or concurrently. This laboratory includes instruction and practice on conventional and advanced machine tools and a manufacturing project. Laboratory: equivalent to fours hours per week, alternate weeks.

Rationale:
By creating a stand alone lab for MIAE 311 Manufacturing Processes, now 3.00cr, it gives us the opportunity to improve the contents and develop further activities that will add value to students' portfolios. It also provides for flexibility in scheduling.

Resource Implications:
There are no additional resource applications.

Other Programs within which course is listed:

None.

SCHOOL OF GRADUATE STUDIES

MEMO TO: Sandra Gabriele, Vice-Provost, Innovation in Teaching and Learning

FROM: Brad Nelson, Associate Dean, Academic Programs and Development
School of Graduate Studies

DATE: May 5, 2020

SUBJECT: **GRADUATE CURRICULUM CHANGES (MECH-113)**
(CALENDAR – 2020/2021)
DEPARTMENT OF CHEMICAL ENGINEERING
GINA CODY SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

The Graduate Curriculum Committee (GCC) reviewed the curriculum changes approved by the Gina Cody School of Engineering and Computer Science.

The Department of Chemical and Materials Engineering is proposing a new required course *CHME 6981 Chemical Engineering Research Protocols and Safety* to the PhD and MASc programs in Chemical Engineering. The Department also took the opportunity to make minor changes to the structure of the programs and added course descriptions for *ENGR 8901 Master of Applied Science Research and Thesis* And *ENGR 8911 Doctoral Research and Thesis*.

The GCC approved the curriculum changes with minor modifications. I therefore recommend that the Academic Programs Committee approve and recommend to Senate the above-mentioned curriculum changes in their final form.

cc: M. Debbabi, Associate Dean, Graduate Programs and Research, Gina Cody School of Engineering and Computer Science
J. Johnston, University Curriculum Administrator, Office of the Provost and Vice-President, Academic Affairs

UNIVERSITÉ Concordia UNIVERSITY

GINA CODY SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

INTERNAL MEMORANDUM

TO: Dr. Bradley Nelson
Chair, Graduate Curriculum Committee
School of Graduate Studies

FROM: Dr. M. Debbabi
Associate Dean, Graduate Programs and Research
Faculty of Engineering and Computer Science

CC: Kristy Clarke
Academic Programs and Development
School of Graduate Studies

DATE: April 20, 2020

RE: **Graduate Curriculum Proposal for the 2020-21 Academic Year (CME-2)**
Gina Cody Council of Engineering and Computer Science

At its meeting on April 17, 2020, the Council of the Gina Cody School of Engineering and Computer Science reviewed and approved, as presented, the creation of a new course "***CHME 6981 Chemical Engineering Research Protocols and Safety***, as well as changes to the requirements of the MASc and PhD programs in Chemical Engineering proposed by the Department of Chemical and Materials Engineering.

Details of the curriculum items are indicated and explained in the internal memorandums and in the CME-2 dossier.

We kindly request that this dossier be placed on the next agenda of the Graduate Curriculum Committee.

Thank you for your consideration of this proposal.

INTERNAL MEMORANDUM

Université Concordia University
GINA CODY SCHOOL OF ENGINEERING AND COMPUTER SCIENCE
Office of the Dean

TO: Dr. Amir Asif
Chair of the Faculty Council
Gina Cody School of Engineering and Computer Science

FROM: Dr. M. Debbabi
Associate Dean, Graduate Programs and Research
Gina Cody School of Engineering and Computer Science

DATE: April 7, 2020

RE: **Graduate Curriculum Proposal for the 2020-21 Academic Year (CME-2)**
Department of Chemical Engineering (CME)

At its virtual meeting on March 31, 2020, the Engineering and Computer Science Graduate Studies Committee (ECSGSC) reviewed and approved, the curriculum items from the Department of Chemical Engineering. Namely, changes to the MASc and PhD programs in Chemical Engineering, as well as the introduction of a new permanent course ***CHME 6981 Chemical Engineering Research Protocols and Safety***.

Details of the graduate curriculum proposal are indicated and explained in the Department's internal memorandum and in the CME-2 dossier.

We kindly request that this proposal be placed on the next agenda of the GCS Council for approval.

Thank you for your consideration of this proposal.

UNIVERSITÉ Concordia UNIVERSITY

GINA CODY
SCHOOL OF ENGINEERING
AND COMPUTER SCIENCE

Department of Chemical
and Materials Engineering

Alex De Visscher
Professor and Chair

alex.devisscher@concordia.ca
Tel.: 514-848-2424 ext. 3488
EV 2.285

March 13, 2020

INTERNAL MEMORANDUM – revision September 15, 2020

To: Dr. Mourad Debbabi, Associate Dean, Research and Graduate Studies

From: Alex De Visscher
Chair, Department of Chemical and Materials Engineering

Re: Program changes to the MASc and PhD programs in Chemical Engineering

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Dear Dr. Debbabi,

The Department of Chemical and Materials Engineering recommends a program change for the MASc and PhD programs in Chemical Engineering. The main program change is the introduction of a new course, *Chemical Engineering Research Protocols and Safety* (CHME 6981). This course is being introduced to fulfill the requirements of the Bureau de cooperation interuniversitaire (BCI) for the approval of the MASc and PhD programs in Chemical Engineering.

One of the requirements for the approval of the graduate program is to incorporate the safety training required for research in chemical engineering formally in the program, rather than offering the safety training outside the program. The proposed course fulfills this requirement and also addresses the BCI's recommendation to include a seminar component to the MASc program. The course will be offered as a four-credit course and will be part of the course component of the programs (16 credits for the MASc, 12 credits for the PHD). During the site visit, some BCI members voiced the concern that the proposed programs are too course-heavy. By incorporating this material as part of the regular course load rather than in addition to the course load, we wish to address this concern.

We also took the opportunity to make some tweaks to the programs. For instance, a course that was an elective in the Master program is moved to the core course list, and a computational chemistry course was added to the course lists in both programs. The latter addition was made in consultation with Dr. Peslherbe, Director of the Centre for Research on Molecular Modeling, who also teaches the course. The Department of Chemistry and Biochemistry was notified of this change.

The calendar text was also edited for clarity.

I would greatly appreciate it if you could discuss this proposal at the next GSC meeting of the Gina Cody School of Engineering and Computer Science.

Feel free to contact me if you have any questions or comments.

Best regards,

Alex De Visscher

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **CME-2** VERSION: 6

PROGRAM CHANGE: Chemical Engineering MASc

Proposed [ ] Undergraduate or [X] Graduate Curriculum Changes

Calendar for academic year: 2020/2021
Implementation Month/Year: January 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Chemical and Materials Engineering (CME)
Program: Chemical Engineering
Degree: MASc
Calendar Section/Graduate Page Number: Eng.Programs:General Requirements-CME

Type of Change:
[X] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar	**Proposed Text**
~~*** Subject to MEES approval**~~ **Admission Requirements** • Bachelor's/baccalaureate degree (or equivalent) in engineering or the sciences with high standing (e.g., with honours, or the Concordia equivalent of a GPA of at least 3.00 on a scale of 4.30). The Department Graduate Studies Committee will determine the acceptability of an applicant for admission to the program and may require the applicant to do specific remedial coursework, including the bridge course CHME 401 Principles of Chemical Engineering, and/or other course(s) to meet the program requirements. ~~Credible academic references and a statement of purpose are required.~~ **Degree Requirements** Fully-qualified candidates are required to complete a minimum of 45 credits. **16 credits – Chosen from Core and Electives**	**Admission Requirements** • Bachelor's/baccalaureate degree (or equivalent) in engineering or the sciences with high standing (e.g., with honours, or the Concordia equivalent of a GPA of at least 3.00 on a scale of 4.30). The Department Graduate Studies Committee will determine the acceptability of an applicant for admission to the program and may require the applicant to do specific remedial coursework, including the bridge course CHME 401 Principles of Chemical Engineering, and/or other course(s) to meet the program requirements. **Degree Requirements** Fully-qualified candidates are required to complete a minimum of 45 credits. **16 credits – Chosen from Required, Core and Elective courses** **Required:** 4 credits: CHME 6981 - Chemical Engineering Research Protocols and Safety

Core: **At least ~~8~~ credits (~~two courses~~) chosen from:** **CHME 6011 - Advanced Transport Phenomena** **CHME 6021 - Advanced Chemical Engineering Thermodynamics** **CHME 6031 - Chemical Kinetics and Reaction Engineering** **CHME 6041 - Chemical Engineering Process Dynamics and Control** **CHME 6051 - Chemical Process Engineering and Design** **CHME 6071 - Materials Science and Engineering** **CHME 6121 - Nanomaterials Science and Engineering** **ENCS 6021 - Engineering Analysis** **Electives:** **Up to 8 credits (two courses) from ~~lists 1, 2, or 3~~ (Core and Electives: 16 credits)** **Students may take an elective course outside ~~lists 1, 2, or 3~~ with permission of the Graduate Program Director.** **Students who take a three-credit course towards their course requirement of 16 credits must take the one-credit course ~~CHME 6001~~ CHME 6001 - Project in Chemical and Materials Engineering to obtain the missing credit.** **~~ENGR 8901 - Master of Applied Science Research and Thesis: 29 credits~~** **List ~~1~~:** **CHME 6061 - Advanced Biochemical Engineering** **CHME 6081 - Advanced Separation Processes** **CHME 6091 - Statistics for Chemical Engineering** **CHME 6101 - Advanced Battery Materials and Technologies** **CHME 6111 - Polymer Chemistry and Engineering** **CHME 6131 - Advanced Colloid and Interface Science and Engineering** **CHME 6911 - Topics in Chemical Engineering I** **ENCS 6111 - Numerical Methods** **ENGR 6201 - Fluid Mechanics** **MECH 6131 - Conduction and Radiation Heat Transfer** **MECH 6141 - Heat Exchanger Design** **MECH 7101 - Convection Heat Transfer** **~~List 2:~~** **CHME 7911 - Topics in Chemical Engineering II** **ENGR 6601 - Principles of Solar Engineering** **ENGR 6971 - Project and Report I** **MECH 6571 - Corrosion and Oxidation of Metals** **Any courses listed in Topic Areas E03, E04, E07, E37, E52, and E57 not included in the core course list of the MEng program in Chemical Engineering or in List 1**	**Core:** At least 4 credits (one course) chosen from: CHME 6011 - Advanced Transport Phenomena CHME 6021 - Advanced Chemical Engineering Thermodynamics CHME 6031 - Chemical Kinetics and Reaction Engineering CHME 6041 - Chemical Engineering Process Dynamics and Control CHME 6051 - Chemical Process Engineering and Design CHME 6071 - Materials Science and Engineering CHME 6081 - Advanced Separation Processes CHME 6121 - Nanomaterials Science and Engineering ENCS 6021 - Engineering Analysis **Electives:** Up to 8 credits (two courses) from the Electives List (Required, Core and Elective courses: 16 credits) Students may take an elective course outside the Electives List with permission of the Graduate Program Director. Students who take a three-credit course towards their course requirement of 16 credits must take the one-credit course CHME 6001 - Project in Chemical and Materials Engineering to obtain the missing credit. **Electives List:** CHME 6061 - Advanced Biochemical Engineering CHME 6091 - Statistics for Chemical Engineering CHME 6101 - Advanced Battery Materials and Technologies CHME 6111 - Polymer Chemistry and Engineering CHME 6131 - Advanced Colloid and Interface Science and Engineering CHME 6911 - Topics in Chemical Engineering I ENCS 6111 - Numerical Methods ENGR 6201 - Fluid Mechanics MECH 6131 - Conduction and Radiation Heat Transfer MECH 6141 - Heat Exchanger Design MECH 7101 - Convection Heat Transfer CHME 7911 - Topics in Chemical Engineering II ENGR 6601 - Principles of Solar Engineering ENGR 6971 - Project and Report I MECH 6571 - Corrosion and Oxidation of Metals Any courses listed in Topic Areas E03, E04, E07, E37, E52, and E57 not included in the core course list of the MEng program in Chemical Engineering or in List 1 Any course(s) listed in Topic Areas E08 and E09. CHEM 631: Computational Chemistry

~~List 3:~~ • **Any course(s) listed in Topic Areas E08 and E09.** **29 credits – Thesis** **ENGR 8901 - Master of Applied Science Research and Thesis (29 credits)** **According to the University regulations on transfer of credits, students who have completed a graduate Certificate or Diploma may have courses transferred into a MASc. Please refer to the Transfer Credits section of the Graduate Calendar for further information.**	**29 credits – Thesis** ENGR 8901 - Master of Applied Science Research and Thesis (29 credits) According to the University regulations on transfer of credits, students who have completed a graduate Certificate or Diploma may have courses transferred into a MASc. Please refer to the Transfer Credits section of the Graduate Calendar for further information.

Rationale:
The Bureau de cooperation interuniversitaire (BCI) conditionally approved the MASc and PhD programs in Chemical Engineering. One of the conditions of the approval is the integration of lab safety training in the programs. The required course, CHME 6981, is created to fulfill this requirement. The BCI also made the (nonbinding) recommendation to introduce a seminar in the program. The seminar component of the course addresses this recommendation. The course will be part of the 16-credit course requirement of the MASc program in Chemical Engineering. The members of the BCI visiting committee felt that the MASc and PhD programs were too course-heavy, and the program change will address this concern.

The line "* Subject to MEES approval" can be removed when the Provincial Government formally approves the program.

The line "Credible academic references and a statement of purpose are required" is removed for consistency with other Engineering graduate programs.

Course CHME 6081, Advanced Separation Processes was moved to the core list to make the list more representative of the broad range of areas covered by core chemical and materials engineering.

A Chemistry graduate course was added to the course list to give students an additional option to broaden their horizon. This proposed change was made in consultation with the Director of the Centre for Research on Molecular Modeling. The Department of Chemistry and Biochemistry was notified.

The remaining changes were made to add clarity to the text.

Resource Implications:
The new required course, CHME 6981 will be taught by one of the current faculty members as part of their normal teaching load.

The course will increase the training load of the EH&S Department slightly (most students would take the training anyway) but the training activities will be more streamlined, offsetting the increased load.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **CME-2** VERSION: 6

PROGRAM CHANGE: Chemical Engineering PhD

Proposed [ ] Undergraduate or [X] Graduate Curriculum Changes

Calendar for academic year: 2020/2021
Implementation Month/Year: January 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Chemical and Materials Engineering (CME)
Program: Chemical Engineering
Degree: PhD
Calendar Section/Graduate Page Number: Eng. Programs:General requirements-CME

Type of Change:
[X] Editorial [X] Requirements [ ] Regulations [ ] Program Deletion [ ] New Program

Present Text (from 2020/2021) calendar	**Proposed Text**
~~*** Subject to MEES approval**~~ **Admission Requirements** Admission on a full-time basis: • Master's degree or equivalent with high standing in engineering or the sciences. Holders of a bachelor's degree will, in general, be considered for admission to a master's program only. After completion of a minimum of two terms of full- time study, they may, upon application, be considered by the GCS Graduate Studies Committee for admission to a PhD program (please see Graduate Calendar regulations on accelerated admission to PhD programs). The Department Graduate Studies Committee will determine the acceptability of an applicant for admission to the program and may require the applicant to do specific remedial course work, including the bridge course CHME 401 Principles of Chemical Engineering, and/or other course(s) to meet the program requirements. ~~Credible academic references and a statement of purpose are required.~~	**Admission Requirements** Admission on a full-time basis: • Master's degree or equivalent with high standing in engineering or the sciences. Holders of a bachelor's degree will, in general, be considered for admission to a master's program only. After completion of a minimum of two terms of full- time study, they may, upon application, be considered by the GCS Graduate Studies Committee for admission to a PhD program (please see Graduate Calendar regulations on accelerated admission to PhD programs). The Department Graduate Studies Committee will determine the acceptability of an applicant for admission to the program and may require the applicant to do specific remedial course work, including the bridge course CHME 401 Principles of Chemical Engineering, and/or other course(s) to meet the program requirements. **Degree Requirements** See the description of the PhD requirements in the general section on the Gina Cody School of Engineering and Computer Science Fully-qualified candidates are required to complete a minimum of 90 credits. **12 credits – Chosen from Core and Electives**

Degree Requirements

See the description of the PhD requirements in the general section on the Gina Cody School of Engineering and Computer Science
Fully-qualified candidates are required to complete a minimum of 90 credits.

12 credits – Chosen from Core and Electives

~~**Core:**~~
~~At least 4 credits (one course) chosen from:~~
~~CHME 6011 - Advanced Transport Phenomena (4 credits)~~
~~CHME 6021 - Advanced Chemical Engineering Thermodynamics (4 credits)~~
~~CHME 6031 - Chemical Kinetics and Reaction Engineering (4 credits)~~
~~CHME 6041 - Chemical Engineering Process Dynamics and Control (4 credits)~~
~~CHME 6051 - Chemical Process Engineering and Design (4 credits)~~
~~CHME 6071 - Materials Science and Engineering (4 credits)~~
~~CHME 6121 - Nanomaterials Science and Engineering (4 credits)~~
~~ENCS 6021 - Engineering Analysis (4 credits)~~

~~**Electives:**~~
~~Up to 8~~ credits (two courses) from ~~lists 1, 2, or 3 (Core and Electives: 12 credits)~~.
Students may take a~~n elective~~ course outside ~~lists 1, 2, or 3~~ with permission of the Graduate Program Director.
Students who take a three-credit course towards their course requirement of 12 credits must take course CHME 6001 CHME 6001 - Project in Chemical and Materials Engineering to obtain the missing credit.

List ~~1~~:
CHME 6061 - Advanced Biochemical Engineering
CHME 6081 - Advanced Separation Processes
CHME 6091 - Statistics for Chemical Engineering
CHME 6101 - Advanced Battery Materials and Technologies
CHME 6111 - Polymer Chemistry and Engineering
CHME 6131 - Advanced Colloid and Interface Science and Engineering
CHME 6911 - Topics in Chemical Engineering I
ENCS 6111 - Numerical Methods
ENGR 6201 - Fluid Mechanics
MECH 6131 - Conduction and Radiation Heat Transfer
MECH 6141 - Heat Exchanger Design
MECH 7101 - Convection Heat Transfer

~~**List 2:**~~

Required:
4 credits:
CHME 6981 - Chemical Engineering Research Protocols and Safety

Students who have taken this course before must substitute a different course for this course.

Other courses:

Eight credits (two courses) from the course list below.
Students may take a course outside the course list with permission of the Graduate Program Director.
Students who take a three-credit course towards their course requirement of 12 credits must take course CHME 6001 CHME 6001 - Project in Chemical and Materials Engineering to obtain the missing credit.

Course list:

CHME 6011 - Advanced Transport Phenomena
CHME 6021 - Advanced Chemical Engineering Thermodynamics
CHME 6031 - Chemical Kinetics and Reaction Engineering
CHME 6041 - Chemical Engineering Process Dynamics and Control
CHME 6051 - Chemical Process Engineering and Design
CHME 6071 - Materials Science and Engineering
CHME 6081 - Advanced Separation Processes
CHME 6121 - Nanomaterials Science and Engineering
ENCS 6021 - Engineering Analysis
CHME 6061 - Advanced Biochemical Engineering
CHME 6091 - Statistics for Chemical Engineering
CHME 6101 - Advanced Battery Materials and Technologies
CHME 6111 - Polymer Chemistry and Engineering
CHME 6131 - Advanced Colloid and Interface Science and Engineering
CHME 6911 - Topics in Chemical Engineering I
ENCS 6111 - Numerical Methods
ENGR 6201 - Fluid Mechanics
MECH 6131 - Conduction and Radiation Heat Transfer
MECH 6141 - Heat Exchanger Design
MECH 7101 - Convection Heat Transfer
CHME 7911 - Topics in Chemical Engineering II
ENGR 6601 - Principles of Solar Engineering
ENGR 6971 - Project and Report I
MECH 6571 - Corrosion and Oxidation of Metals
Any courses listed in Topic Areas E03, E04, E07, E37, E52, and E57 not included in the core course list of the MEng program in Chemical Engineering or in List 1
Any course(s) listed in Topic Areas E08 and E09.

CHME 7911 - Topics in Chemical Engineering II ENGR 6601 - Principles of Solar Engineering ENGR 6971 - Project and Report I MECH 6571 - Corrosion and Oxidation of Metals Any courses listed in Topic Areas E03, E04, E07, E37, E52, and E57 not included in the core course list of the MEng program in Chemical Engineering or in List 1 ~~**List 3:**~~ Any course(s) listed in Topic Areas E08 and E09. **2 credits – Seminar** ENCS 8011 - PhD Seminar (2 credits) **6 credits – Comprehensive Examination and Research Proposal** ENCS 8501 - Comprehensive Examination (no credit value) ENCS 8511 - Doctoral Research Proposal (6 credits) **70 credits – Thesis** ENGR 8911 - Doctoral Research and Thesis (70 credits) ~~Students who are permitted to fast-track to the PhD program (please see Graduate Calendar regulations on accelerated admission to PhD programs) must complete a total of 28 course credits, at least 12 of which should be from the core course list, and the remainder of which should come from lists 1, 2, or 3, not including Topic Area E08 or ENGR 6971.~~	CHEM 631 - Computational Chemistry **2 credits – Seminar** ENCS 8011 - PhD Seminar (2 credits) **6 credits – Comprehensive Examination and Research Proposal** ENCS 8501 - Comprehensive Examination (no credit value) ENCS 8511 - Doctoral Research Proposal (6 credits) **70 credits – Thesis** ENGR 8911 - Doctoral Research and Thesis (70 credits)

Rationale:

The Bureau de cooperation interuniversitaire (BCI) conditionally approved the MASc and PhD programs in Chemical Engineering. One of the conditions of the approval is the integration of lab safety training in the programs. The required course, CHME 6981, is created to fulfill this requirement. The BCI also made the (nonbinding) recommendation to introduce a seminar in the program. The seminar component of the course addresses this recommendation. The course will be part of the 12-credit course requirement of the PhD program, unless the student has taken the course before. The members of the BCI visiting committee felt that the MASc and PhD programs were too course-heavy, and the program change will address this concern.

The line "* Subject to MEES approval" can be removed when the Provincial government formally approves the program.

The line "Credible academic references and a statement of purpose are required" is removed for consistency with other Engineering graduate programs.

The course requirements for fast-tracking are removed because the rules are already set out in the Admission section of the graduate calendar, subsection Fast Track to PhD Programs, and in the graduate calendar, section Gina Cody School of Engineering and Computer Science, section Engineering Programs, section, PhD, section Courses.

A Chemistry graduate course was added to the course list to give students an additional option to broaden their horizon. This proposed change was made in consultation with the Director of the Centre for Research on Molecular Modeling. The Department of Chemistry and Biochemistry was notified.

The remaining changes were made to add clarity to the text.

Resource Implications:

The new required course, CHME 6981 will be taught by one of the current faculty members as part of their normal teaching load.

The course will increase the training load of the EH&S Department slightly (most students would take the training anyway) but the training activities will be more streamlined, offsetting

the increased load.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **CME-2** VERSION: 6

COURSE CHANGE: CHME 6981 New Course Number:

Proposed [ ] Undergraduate or [X] Graduate Curriculum Changes

Calendar for academic year: 2020/2021
Implementation Month/Year: January 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Chemical and Materials Engineering (CME)
Program: Chemical Engineering
Degree: MASc, PhD
Calendar Section/Graduate Page Number: Engineering courses:Chemical Eng.

Type of Change:

[ ] Course Number	[ ] Course Title	[ ] Credit Value	[ ] Prerequisite
[ ] Course Description	[ ] Editorial	[X] New Course	
[ ] Course Deletion	[ ] Other - Specify:		

Present Text (from 20xx/20xx) calendar	**Proposed Text**
	CHME 6981 Chemical Engineering Research Protocols and Safety (4 credits) The purpose of this course is to provide the tools to conduct research in chemical engineering in a safe and professional manner. The course provides all the safety training necessary for chemical engineering research. Students are also trained in Standard Operating Procedures (SOP) for chemical engineering research, and on how to respond in the case of chemical accidents, including first aid. Additional topics are covered on a rotating basis and may include safety regulations in the chemical industry, automation of chemical experiments, chemical and material data collection and usage, chemometrics, chemical process simulation, molecular modelling tools, advanced research and publication strategies, proposal writing, etc. A seminar is held, where each student is required to present. This is a pass/fail course. A project is required.

Rationale:
The Bureau de cooperation interuniversitaire (BCI) conditionally approved the MASc and PhD programs in Chemical Engineering. One of the conditions of the approval is the integration of lab safety training in the programs. This course is created to fulfill this requirement. The BCI also made the (nonbinding) recommendation to introduce a seminar in the program. The seminar component of the course addresses this recommendation.

The course will be part of the 16-credit course requirement of the MASc program in Chemical Engineering and part of the 12-credit course requirement of the PhD program, unless the student has taken the course before. The members of the BCI visiting committee felt that the MASc and PhD programs were too course-heavy, and the program change will address this concern.

Resource Implications:
The course will be taught by one of the current faculty members as part of their normal teaching load.

The course will increase the training load of the EH&S Department slightly (most students would take the training anyway) but the training activities will be more streamlined, offsetting the increased load.

Other Programs within which course is listed:

n/a

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **CME-2** VERSION: 6

COURSE CHANGE: ENGR 8901 New Course Number:

Proposed [ ] Undergraduate or [X] Graduate Curriculum Changes

Calendar for academic year: 2020/2021
Implementation Month/Year: January 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Chemical and Materials Engineering (CME)
Program: Chemical Engineering
Degree: MASc
Calendar Section/Graduate Page Number:

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 2020/2021) calendar	**Proposed Text**
	ENGR 8901 - Master of Applied Science Research and thesis (29 credits) Students are required to write a thesis in accordance with the thesis guidelines of the School of Graduate Studies. The thesis involves a literature review of the field of research, and reports on the planning and execution of innovative and original research conducted under supervision of a faculty member. The thesis is evaluated by a thesis committee and is the object of an oral defense, under the guidelines of the School of Graduate Studies.

Rationale:
There was no course description for the thesis yet.

Resource Implications:
None.

Other Programs within which course is listed:

All thesis-based Master programs in Engineering and Computer Science.

PROGRAM AND COURSES CHANGE FORMS FOR DOCUMENT: **CME-2** VERSION: 6

COURSE CHANGE: ENGR 8911 New Course Number:

Proposed [ ] Undergraduate or [X] Graduate Curriculum Changes

Calendar for academic year: 2020/2021
Implementation Month/Year: January 2021

Faculty/School: Gina Cody School of Engineering and Computer Science
Department: Department of Chemical and Materials Engineering (CME)
Program: Chemical Engineering
Degree: PhD
Calendar Section/Graduate Page Number:

Type of Change:

[ ] Course Number [ ] Course Title [ ] Credit Value [ ] Prerequisite
[X] Course Description [ ] Editorial [ ] New Course
[ ] Course Deletion [ ] Other - Specify:

Present Text (from 20xx/20xx) calendar	**Proposed Text**
	ENGR 8911 - Doctoral Research and Thesis (70 credits) Students are required to write a thesis in accordance with the thesis guidelines of the School of Graduate Studies. The thesis involves a literature review of the field of research, and reports on the planning and execution of innovative and original research conducted under supervision of a faculty member. The thesis is evaluated by a thesis committee and is the object of an oral defense, under the guidelines of the School of Graduate Studies.

Rationale:
There was no course description for theses yet.

Resource Implications:
None.

Other Programs within which course is listed:

All PhD programs in Engineering and Computer Science.

CONCORDIA UNIVERSITY
GINA CODY SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

CHEMICAL ENGINEERING RESEARCH PROTOCOLS AND SAFETY (CHME 6981)

OUTLINE OF THE COURSE CONTENT

The purpose of this course is to provide the tools to conduct research in chemical engineering in a safe and professional manner. The course provides all the safety training necessary for chemical engineering research. Students are also trained in Standard Operating Procedures (SOP) for chemical engineering research, and on how to respond in the case of chemical accidents, including first aid. Additional topics are covered on a rotating basis and may include safety regulations in the chemical industry, automation of chemical experiments, chemical and material data collection and usage, chemometrics, chemical process simulation, molecular modelling tools, advanced research and publication strategies, proposal writing, etc. A seminar is held, where each student is required to present. This is a pass/fail course. A project is required.

REFERENCES

EVALUATION

This is a pass/fail course. In order to pass the course, **ALL** the following criteria must be met:

Safety training courses	**pass each one**
Presentations	**presentation made on seminar**
Project: SOP development	**passing grade on SOP report**

Main Topics

- Week 1: Introduction to Chemical Engineering Research Protocols and Safety
- Week 2: WHMIS, waste disposal, hazardous materials
- Week 3: Nanomaterials*, corrosives, safe storage, spill response
- Week 4: Transport of dangerous goods, biosafety*, laser safety*
- Week 5-6: Standard Operation Procedures (SOP) in a chemical engineering research environment; term project introduction
- Week 7-8: Material Safety Data Sheets (MSDS), emergency response and first aid in the case of chemical accidents
- Week 9: Safety regulations in chemical industry
- Week 10: Advanced research, publication and presentation strategies; proposal writing
- Week 11: Chemical and material property data collection and usage, chemometrics
- Week 12: Chemical process simulation, molecular modeling tools
- Week 13: Student seminars

*If required for individual research of the student

Disclaimer: In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

Improving Students' Academic Experience

The course outline provides important factual information, which students need to be able to meet the requirements of any course. However, this outline also serves as a reminder to students of all the support services that are available to help achieve academic and personal success

For students that may experience academic or personal difficulties at any point during their academic career, please see the following support services:

LIST OF STUDENT SERVICES

1. Department's Academic Advisor

2. Counselling and Psychological Services: concordia.ca/students/counselling-life-skills
3. Concordia Library Citation and Style Guides: library.concordia.ca/help/howto/citations
4. Student Success Centre: concordia.ca/students/success
5. Health Services: concordia.ca/students/health
6. Financial Aid and Awards: concordia.ca/offices/faao
7. HOJO (Off Campus Housing and Job Bank): csu.qc.ca/hojo
8. Academic Integrity: concordia.ca/students/academic-integrity
9. Access Centre for Students with Disabilities: concordia.ca/offices/acsd
10. CSU Advocacy Centre: csu.qc.ca/advocacy
11. Dean of Students Office: concordia.ca/offices/dean-students.html
12. International Students Office: concordia.ca/students/international
13. Student Hub: concordia.ca/students

US-2020-5-D11

SPRING 2020 AND FALL 2019 GRADUATION STATISTICS

UNIVERSITÉ Concordia UNIVERSITY

Spring 2020 and Fall 2019 Graduation Statistics Summary

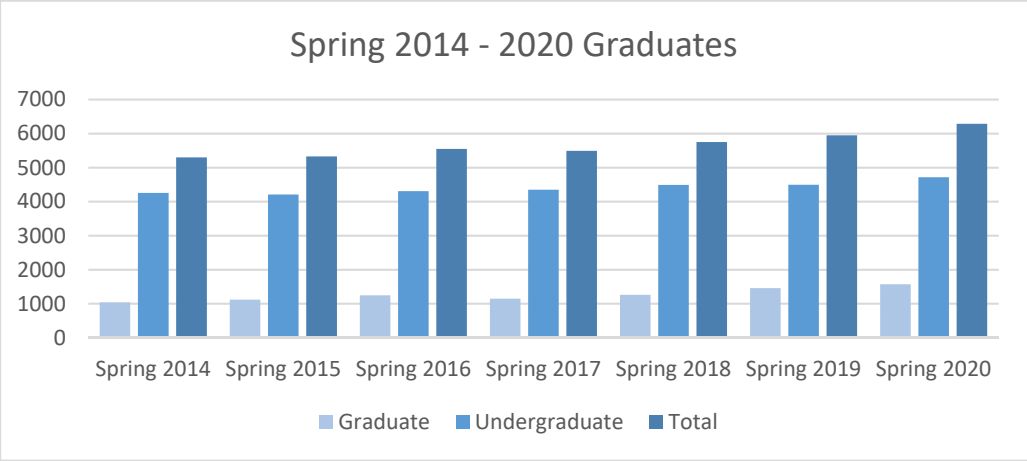
Spring 2020

Spring 2020 saw the largest cohort of graduates with a total of 6286 degrees, diplomas and certificates having been awarded. 75% of these were at the undergraduate level and 25% at the graduate level. As outlined in the chart below, there has been a steady increase in the number of graduates at each level every year.

At the undergraduate level, male students made up 44% of the student population and females 56%.

At the graduate level, male students make up 59% of the student population and females 41%.

Combined, males made up 48% and females 52% of the total graduates



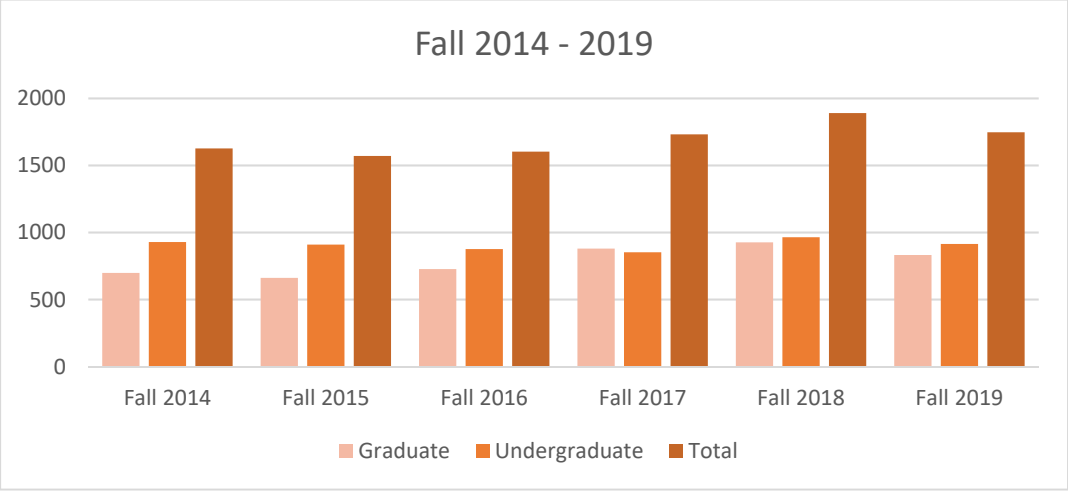
Fall 2019

A total of 1747 degrees, diplomas and certificates were awarded in Fall 2019. 52% of these were at the undergraduate level and 48% at the graduate level. There had been a steady increase in the number of graduates each fall for the four years leading up to Fall 2019. Fall 2019 saw a small decrease over 2018.

At the undergraduate level, male students made up 46% of the student population and females 54%.

At the graduate level, male students make up 56% of the student population and females 44%.

Combined, males made up 51% and females 49% of total graduates.



Reports Table of Contents

Degree Statistics Final

Spring 2020 Graduation

2020-09-30

	Male	Female	Total
Faculty of Arts & Science	**777**	**1676**	**2453**
Graduate	**97**	**185**	**282**
Certificate - Graduate	0	2	2
Diploma - Graduate	12	30	42
Doctor of Philosophy	14	29	43
Master of Arts	56	102	158
Master of Science	10	18	28
Masters of Environment	5	4	9
Undergraduate	**680**	**1491**	**2171**
Bachelor of Arts	505	1185	1690
Bachelor of Arts - COOPs	7	14	21
Bachelor of Education	10	36	46
Bachelor of Science	142	221	363
Bachelor of Science - COOPs	9	12	21
Certificate - Undergraduate	7	23	30
Faculty of Fine Arts	**184**	**371**	**555**
Graduate	**19**	**47**	**66**
Doctor of Philosophy	5	6	11
Master of Arts	6	27	33
Master of Design	0	3	3
Master of Fine Arts	8	11	19
Undergraduate	**165**	**324**	**489**
Bachelor of Fine Arts	165	324	489
Gina Cody School	**1214**	**450**	**1664**
Graduate	**631**	**267**	**898**
Certificate - Graduate	3	1	4
Diploma - Graduate	6	2	8
Doctor of Philosophy	41	11	52
Master of Applied Comp Science	60	25	85
Master of Applied Science	61	25	86
Master of Computer Science	13	5	18
Master of Engineering	447	198	645
Undergraduate	**583**	**183**	**766**
Bachelor of Comp Sc - COOPs	11	6	17
Bachelor of Computer Science	104	23	127
Bachelor of Engineering	371	106	477
Bachelor of Engineering-COOPs	96	48	144
Certificate - Undergraduate	1	0	1

Degree Statistics Final

Spring 2020 Graduation

2020-09-30

John Molson School of Business	811	803	1614
Graduate	**174**	**149**	**323**
Certificate - Graduate	6	12	18
Diploma - Graduate	64	73	137
Doctor of Philosophy	4	2	6
Master of Bus. Admin - COOPs	14	6	20
Master of Business Admin	78	38	116
Master of Science	7	17	24
Master of Supply Chain Mgmt	1	1	2
Undergraduate	**637**	**654**	**1291**
Bachelor of Administration	12	8	20
Bachelor of Commerce	562	561	1123
Bachelor of Commerce - COOPs	56	75	131
Certificate - Undergraduate	7	10	17
Grand Total	**2986**	**3300**	**6286**

Spring 2020 Historical Graduation Statistics – Summary

2020-09-30

Expected Grad. Term	2134	2141	2144	2151	2154	2161	2164	2171	2174	2181	2184	2191	2194
Convocation in	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018	Fall 2018	Spring 2019	Fall 2019	Spring 2020
GRADUATE	**1041**	**698**	**1121**	**661**	**1245**	**727**	**1146**	**880**	**1260**	**926**	**1456**	**832**	**1569**
Faculty of Arts & Science	**247**	**200**	**267**	**214**	**299**	**232**	**263**	**243**	**262**	**232**	**299**	**213**	**282**
Certificate - Graduate	0	0	0	0	1	0	0	1	1	0	0	0	2
Diploma - Graduate	51	22	52	38	67	41	47	64	59	46	44	44	42
Master of Arts	124	111	151	108	163	112	153	122	140	105	181	115	158
Master of Arts - COOPs	2	1	1	0	1	2	2	0	0	2	1	0	0
Masters of Environment	13	5	6	6	11	3	13	5	13	7	11	4	9
Master of Science	19	30	23	26	33	32	22	29	25	40	23	27	28
Master of Teaching of Math	3	1	1	2	4	0	1	1	7	1	1	0	0
Doctor of Philosophy	35	30	33	34	19	42	25	21	17	31	38	23	43
Faculty of Fine Arts	**79**	**62**	**58**	**70**	**73**	**70**	**87**	**64**	**67**	**67**	**68**	**75**	**66**
Certificate - Graduate	2	20	1	17	2	6	2	0	0	0	0	0	0
Diploma - Graduate	0	0	0	0	0	9	1	15	0	8	0	13	0
Master of Arts	34	28	23	38	36	43	39	40	29	44	21	48	33
Master of Design	0	0	0	0	0	0	0	0	0	3	2	0	3
Master of Fine Arts	35	8	26	13	27	3	35	5	33	7	32	7	19
Doctor of Philosophy	8	6	8	2	8	9	10	4	5	5	13	7	11
Gina Cody School	**488**	**302**	**547**	**275**	**623**	**356**	**605**	**330**	**658**	**464**	**808**	**437**	**898**
Certificate - Graduate	3	2	8	3	13	6	6	4	14	5	5	4	4
Diploma - Graduate	5	6	8	5	7	17	12	16	16	26	3	15	8
Master of Applied Comp Science	43	11	35	7	36	10	31	10	39	14	60	38	85
Master of Applied Science	85	55	67	48	65	52	69	43	54	73	78	53	86
Master of App. Science - COOPs	1	1	0	1	0	0	1	0	0	0	0	0	0
Master of Computer Science	12	8	12	10	15	7	6	8	7	7	14	15	18
Master of Engineering	302	182	380	171	440	227	441	228	478	294	601	284	645
Master of Science	0	0	0	0	1	0	0	0	0	0	0	0	0
Doctor of Philosophy	37	37	37	30	46	37	39	21	50	45	47	28	52
John Molson School of Business	**227**	**134**	**249**	**102**	**250**	**69**	**191**	**243**	**273**	**163**	**281**	**107**	**323**
Certificate - Graduate	43	10	32	16	41	6	25	3	34	13	29	9	18
Diploma - Graduate	46	82	61	25	55	19	55	110	79	106	106	28	137
Master of Business Admin	116	19	119	34	120	23	74	104	112	20	105	20	116
Master of Bus. Admin - COOPs	7	8	5	3	6	6	7	6	19	9	8	21	20
Master of Science	9	11	25	21	25	7	26	14	19	14	25	27	24
Master of Supply Chain Mgmt	0	0	0	0	0	0	0	0	1	0	1	0	2
Doctor of Philosophy	6	4	7	3	3	8	4	6	9	1	7	2	6
Total Graduate	**1041**	**698**	**1121**	**661**	**1245**	**727**	**1146**	**880**	**1260**	**926**	**1456**	**832**	**1569**

Spring 2020 Historical Graduation Statistics – Summary

2020-09-30

Expected Grad. Term	2134	2141	2144	2151	2154	2161	2164	2171	2174	2181	2184	2191	2194
Convocation in	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018	Fall 2018	Spring 2019	Fall 2019	Spring 2020
UNDERGRADUATE	**4256**	**929**	**4208**	**910**	**4305**	**876**	**4347**	**852**	**4490**	**964**	**4493**	**915**	**4717**
Faculty of Arts & Science	**2000**	**442**	**2023**	**431**	**1986**	**396**	**2024**	**378**	**2076**	**407**	**1975**	**424**	**2171**
Bachelor of Arts	1632	363	1612	347	1616	295	1583	289	1586	307	1525	322	1690
Bachelor of Arts - COOPs	11	0	9	1	11	5	11	1	11	3	19	3	21
Bachelor of Education	26	7	36	4	25	7	16	2	41	5	39	5	46
Bachelor of Science	294	55	321	62	281	70	366	71	395	77	351	81	363
Bachelor of Science - COOPs	8	0	15	0	11	1	14	1	19	0	22	2	21
Certificate - Undergraduate	29	17	30	17	42	18	34	14	24	15	19	11	30
Faculty of Fine Arts	**497**	**107**	**419**	**105**	**487**	**83**	**511**	**76**	**471**	**97**	**501**	**87**	**489**
Bachelor of Fine Arts	497	106	419	104	481	82	507	76	467	97	501	87	489
Bachelor of Fine Arts - COOPs	0	1	0	1	6	1	4	0	4	0	0	0	0
Gina Cody School	**501**	**38**	**554**	**45**	**502**	**66**	**550**	**73**	**665**	**80**	**708**	**85**	**766**
Bachelor of Computer Science	58	8	86	11	66	16	98	14	90	21	106	24	127
Bachelor of Comp Sc - COOPs	12	3	9	3	12	1	8	3	14	4	9	4	17
Bachelor of Engineering	369	22	383	28	354	41	361	44	452	50	464	50	477
Bachelor of Engineering-COOPs	62	5	76	3	69	8	83	12	108	5	129	7	144
Certificate - Undergraduate	0	0	0	0	1	0	0	0	1	0	0	0	1
John Molson School of Business	**1232**	**329**	**1180**	**326**	**1279**	**324**	**1258**	**324**	**1277**	**379**	**1309**	**319**	**1291**
Bachelor of Administration	99	32	87	30	82	16	57	17	25	5	15	3	20
Bachelor of Commerce - COOPs	100	28	92	24	101	24	106	26	112	25	102	24	131
Bachelor of Commerce	1019	257	989	270	1086	277	1080	275	1128	342	1180	285	1123
Certificate - Undergraduate	14	12	12	2	10	7	15	6	12	7	12	7	17
School of Extended Learning	**26**	**13**	**32**	**3**	**51**	**7**	**4**	**1**	**1**	**1**	**0**	**0**	**0**
Compl Univ Credit Certificate	26	13	32	3	51	7	4	1	1	1	0	0	0
Total Undergraduate	**4256**	**929**	**4208**	**910**	**4305**	**876**	**4347**	**852**	**4490**	**964**	**4493**	**915**	**4717**

Concordia University
Graduation Statistics – Overall by Faculty - Spring 2020
As of 2020-09-30

	2184 Spring 2019	2194 Spring 2020	Difference
Faculty of Arts & Science	**2274**	**2453**	**179**
Bachelor of Arts	1525	1690	165
Bachelor of Arts - COOPs	19	21	2
Bachelor of Education	39	46	7
Bachelor of Science	351	363	12
Bachelor of Science - COOPs	22	21	-1
Certificate - Graduate	0	2	2
Certificate - Undergraduate	19	30	11
Diploma - Graduate	44	42	-2
Doctor of Philosophy	38	43	5
Master of Arts	181	158	-23
Master of Arts - COOPs	1	0	-1
Master of Science	23	28	5
Master of Teaching of Math	1	0	-1
Masters of Environment	11	9	-2
Faculty of Fine Arts	**569**	**555**	**-14**
Bachelor of Fine Arts	501	489	-12
Doctor of Philosophy	13	11	-2
Master of Arts	21	33	12
Master of Design	2	3	1
Master of Fine Arts	32	19	-13
Gina Cody School of Engineering & Computer Science	**1516**	**1663**	**147**
Bachelor of Comp Sc - COOPs	9	17	8
Bachelor of Computer Science	106	127	21
Bachelor of Engineering	464	476	12
Bachelor of Engineering-COOPs	129	144	15
Certificate - Graduate	5	4	-1
Certificate - Undergraduate	0	1	1
Diploma - Graduate	3	8	5
Doctor of Philosophy	47	52	5
Master of Applied Comp Science	60	85	25
Master of Applied Science	78	86	8
Master of Computer Science	14	18	4
Master of Engineering	601	645	44
John Molson School of Business	**1574**	**1613**	**39**
Bachelor of Administration	15	20	5
Bachelor of Commerce	1180	1123	-57
Bachelor of Commerce - COOPs	86	130	44
Certificate - Graduate	29	18	-11
Certificate - Undergraduate	12	17	5

Diploma - Graduate	106	137	31
Doctor of Philosophy	7	6	-1
Master of Bus. Admin - COOPs	8	20	12
Master of Business Admin	105	116	11
Master of Science	25	24	-1
Master of Supply Chain Mgmt	1	2	1
School of Graduate Studies	**2**	**0**	**-2**
Certificate - Graduate	2	0	-2
The Centre for Continuing Education	**166**	**106**	**-60**
Language Study CCE	96	43	-53
Professional Career Study CCE	70	63	-7
Total	**6101**	**6390**	**289**

CONCORDIA UNIVERSITY

Spring 2020
Prize Report

University-Wide

The Governor General's Silver Medal	Armel Jolin
The Governor General's Gold Medal	Irene Rozsa
The Concordia University Distinguished Doctoral Dissertation Prize (Engineering and Natural Sciences)	Yazan Al-Alem
The Concordia University Distinguished Doctoral Dissertation Prize (Fine Arts, Humanities and Social Sciences)	Gwynne Fulton
The Rytsa Tobias Memorial Medal	Armel Jolin
The Anne Stokes Medal	Marco Garofalo
The Mappin Medal	Francis Carter
The Administration Medal	Michael Nasrallah
The Commerce Medal	Jonathan Hendy-LaMendola
The Computer Science Medal	Arman Najafian
The Chait Medal	Mikaël Turcotte
The Alfred Pinsky Medal	Jonathan Monro

Arts & Science

The Robert C. Rae Book Prize in Human Relations	Bianca Boyer-D'Alesio
The Biology Prize	Ana Maria Hincapie
The Randy B. Swedburg Medal for Leisure Sciences and Therapeutic Recreation	Mattea Elisa Mahut
The Chemistry Medal	Constantinos Blidjios
The Classics Book Prize	Guilia Arianna Heinritzi
The John E. O'Brien, s.j. Medal for Communication Studies	Nicholas Gertler
The Economics Prize	Nicolas van Hell
Balbir Sahni Outstanding International Undergraduate Award in Economics	Viktoriya Kadzhiyeva
The Education Book Prize	Adam Ribkoff
The Medal for English	Emily Cox
Le prix Paul d'Hollander pour les Études françaises	Jennifer Armin-Pereda
The Exercise Science Plaque	Ann-Rebecca Drolet
The Bogdan Zaborski Medal in Geography	Lara Wheeler
The Martin Lewis Memorial Book Prize in History	Devin Murray
The Interdisciplinary Studies Medal	Scott McCallum
The Gordon Fisher Prize for Journalism	MacKenzie Lad
The Liberal Arts College Prize	Ophelie Proulx-Giraldeau
The Eric O'Connor Mathematics Medal	William Ngo
The Modern Languages and Linguistics Plaque	Armel Jolin
The W.R. Fraser Medal for Philosophy	Matilda Cerone
The Walter Raudorf Medal for Physics	Michael Berteau-Rainville
The Renée Vautelet Prize for Political Science	Holdon Carroll
The J.W. Bridges Medal for Psychology	Francis Carter
The Boyd Sinyard Prize for Religion	Anna Kiraly
The Science College Prize	Etienne Maes
The Vince Sirois Prize	Kimberly Belisle-Lawless
The Everett C. Hughes Medal for Sociology and Anthropology	Jesse Massumi
The Thérèse F. Casgrain Medal for Women's Studies	Eva Espenshade

John Molson School Of Business

The Ross Medal for Accountancy	Victoria Cardillo
The Supply Chain and Business Technology Management Medal	Sarah Kanaan
The Finance Medal	Vitalie Crestianov
The International Business Medal	Camille Moumdjian
The Management Medal	Sarah Dorey
The Marketing Medal	Trang Hoang

Engineering & Computer Science

The Aerospace Engineering Medal	Noah Sadaka
The Building Engineering Medal	Carl Bérubé
The Matthew Douglass Medal for Civil Engineering	Mikaël Turcotte
The Computer Engineering Medal	Ming Tao Yu
The Phoivos Ziogas Medal for Electrical Engineering	Mohammad Osama Qalam
The Jaan Saber Medal for Industrial Engineering	Antoine Riachi
The Mechanical Engineering Medal	Trevor Joy
The Software Engineering Medal	Kevin Janeiro

Fine Arts

The Art Education Prize	Elisabeth Harvey
The R. Bella Rabinovitch Art History Prize	Jeanne Blackburn
The Cinema Prize	Zachary Salois-Bennani
The Computation Arts Prize	Emmanuelle Forgues
The Contemporary Dance Prize	Xdzunúm Danae Trejo
The Design Prize	Asa Perlman
The Lydia Sharman Award	Jayda Saydam
The Music Prize	Alexander Simmons
The Yves Gaucher Prize in Studio Arts	Farnaz Zaveh
The Betty Goodwin Prize in Studio Arts	Ursula Oberholzer
The Guido Molinari Prize in Studio Arts	Manuel Poitras
The Gabor Szilasi Prize in Studio Arts	Pedro José Barbáchano Gayao
The Irene F. Whittome Prize in Studio Arts	Elfur Hermannsdottir
The Theatre Prize	Tiernan Cornford

Arts & Science

Le prix d'excellence Armand Verthuy	Rachelle Fox
Balbir Sahni Outstanding International Graduate Award in Economics	Kailun Cao
The Balvir Singh Medal	Nickesha Ayoade
The Edward Eastman McCullough MA History Award	Jesse Coady
The Gordon Fisher Prize for Journalism (Graduate Diploma Program)	Clara Gepner
The Julius and Ilka Ekler Book Prize in Judaic Studies	Ming Hui Pan
The Nishith Mukerji Medal for M.Sc. Physics (Thesis Option)	Franco La Braca
The Herbert F. Quinn Medal for Political Science	Melissa Micu

John Molson School of Business

The Uma and Mahesh Sharma Graduate Award	*Not awarded*
The Joe Kelly Graduate Award	Anika Sisto

Engineering & Computer Science

The F.A. Gerard Prize (non-thesis)	Sobhan Kouhestani
The Doctoral Prize in Engineering and Computer Science	Suryadipta Majumdar
The F.A. Gerard Prize (thesis)	Quanliang Zhao

Non-Academic

The Concordia Medal	Philippe Boucher
The Dean of Students Medal	Maurice Ngwakum-Akisa
The Malone Medal	Nicholas Gertler and Marguerite Rolland
The O'Brien Medal	Pierre Dushime
The Provost's Medal for Outstanding Achievement	Kelly Burchell-Reyes
The Stanley G. French Medal	*Not awarded*

Grey highlight indicates “on pending list”

CONCORDIA UNIVERSITY

Spring 2020

THE GOVERNOR GENERAL'S GOLD MEDAL – PEOPLE AND SOCIETY CATEGORY

Conferred by Her Excellency, the Governor General of Canada.

Irene Rozsa, PhD

Mel Hoppenheim School of Cinema

Faculty of Fine Arts

Thesis Title: *On the Edge of the Screen: Film Culture and Practices of Noncommercial Cinema in Cuba, 1948-1966*

Supervisor: Dr. Maria Salazkina, Mel Hoppenheim School of Cinema

CONCORDIA UNIVERSITY – SPRING 2020

THE GOVERNOR GENERAL'S SILVER MEDAL

Conferred by Her Excellency, the Governor General of Canada, and awarded to the highest ranking undergraduate student graduating from Concordia University.

PRIZE WINNER

Student Name	**Degree and Concentration(s)**
Jolin, Armel	BA Honours Linguistics

N.B. Only Concordia University courses (and Quebec Interuniversity courses taken since the Summer 1997 academic term) are included in the calculation of the Prize GPA.

Degree Statistics Final

Fall 2019 Graduation

2020-09-30

	Male	Female	Total
Faculty of Arts & Science	**213**	**424**	**637**
Graduate	**72**	**141**	**213**
Diploma - Graduate	13	31	44
Doctor of Philosophy	7	16	23
Master of Arts	38	77	115
Master of Science	13	14	27
Masters of Environment	1	3	4
Undergraduate	**141**	**283**	**424**
Bachelor of Arts	106	216	322
Bachelor of Arts - COOPs	0	3	3
Bachelor of Education	1	4	5
Bachelor of Science	31	50	81
Bachelor of Science - COOPs	1	1	2
Certificate - Undergraduate	2	9	11
Faculty of Fine Arts	**62**	**100**	**162**
Graduate	**21**	**54**	**75**
Diploma - Graduate	4	9	13
Doctor of Philosophy	4	3	7
Master of Arts	11	37	48
Master of Fine Arts	2	5	7
Undergraduate	**41**	**46**	**87**
Bachelor of Fine Arts	41	46	87
Gina Cody School	**389**	**133**	**522**
Graduate	**320**	**117**	**437**
Certificate - Graduate	3	1	4
Diploma - Graduate	11	4	15
Doctor of Philosophy	22	6	28
Master of Applied Comp Science	25	13	38
Master of Applied Science	43	10	53
Master of Computer Science	13	2	15
Master of Engineering	203	81	284
Undergraduate	**69**	**16**	**85**
Bachelor of Comp Sc - COOPs	4	0	4
Bachelor of Computer Science	19	5	24
Bachelor of Engineering	41	9	50
Bachelor of Engineering-COOPs	5	2	7

John Molson School of Business	228	198	426
Graduate	57	50	107
Certificate - Graduate	3	6	9
Diploma - Graduate	9	19	28
Doctor of Philosophy	2	0	2
Master of Bus. Admin - COOPs	16	5	21
Master of Business Admin	17	3	20
Master of Science	10	17	27
Undergraduate	171	148	319
Bachelor of Administration	1	2	3
Bachelor of Commerce	151	134	285
Bachelor of Commerce - COOPs	15	9	24
Certificate - Undergraduate	4	3	7
Grand Total	**892**	**855**	**1747**

Fall 2019 Historical Graduation Statistics – Summary

2020-09-30

Expected Grad. Term	2131	2134	2141	2144	2151	2154	2161	2164	2171	2174	2181	2184	2191
Convocation in	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018	Fall 2018	Spring 2019	Fall 2019
GRADUATE	**680**	**1041**	**698**	**1121**	**661**	**1245**	**727**	**1146**	**880**	**1260**	**926**	**1456**	**832**
Faculty of Arts & Science	**218**	**247**	**200**	**267**	**214**	**299**	**232**	**263**	**243**	**262**	**232**	**299**	**213**
Certificate - Graduate	9	0	0	0	0	1	0	0	1	1	0	0	0
Diploma - Graduate	44	51	22	52	38	67	41	47	64	59	46	44	44
Master of Arts	103	124	111	151	108	163	112	153	122	140	105	181	115
Master of Arts - COOPs	0	2	1	1	0	1	2	2	0	0	2	1	0
Masters of Environment	4	13	5	6	6	11	3	13	5	13	7	11	4
Master of Science	32	19	30	23	26	33	32	22	29	25	40	23	27
Master of Teaching of Math	1	3	1	1	2	4	0	1	1	7	1	1	0
Doctor of Philosophy	25	35	30	33	34	19	42	25	21	17	31	38	23
Faculty of Fine Arts	**73**	**79**	**62**	**58**	**70**	**73**	**70**	**87**	**64**	**67**	**67**	**68**	**75**
Certificate - Graduate	20	2	20	1	17	2	6	2	0	0	0	0	0
Diploma - Graduate	0	0	0	0	0	0	9	1	15	0	8	0	13
Master of Arts	43	34	28	23	38	36	43	39	40	29	44	21	48
Master of Design	0	0	0	0	0	0	0	0	0	0	3	2	0
Master of Fine Arts	5	35	8	26	13	27	3	35	5	33	7	32	7
Doctor of Philosophy	5	8	6	8	2	8	9	10	4	5	5	13	7
Gina Cody School	**274**	**488**	**302**	**547**	**275**	**623**	**356**	**605**	**330**	**658**	**464**	**808**	**437**
Certificate - Graduate	0	3	2	8	3	13	6	6	4	14	5	5	4
Diploma - Graduate	6	5	6	8	5	7	17	12	16	16	26	3	15
Master of Applied Comp Science	9	43	11	35	7	36	10	31	10	39	14	60	38
Master of Applied Science	63	85	55	67	48	65	52	69	43	54	73	78	53
Master of App. Science - COOPs	1	1	1	0	1	0	0	1	0	0	0	0	0
Master of Computer Science	5	12	8	12	10	15	7	6	8	7	7	14	15
Master of Engineering	153	302	182	380	171	440	227	441	228	478	294	601	284
Master of Science	0	0	0	0	0	1	0	0	0	0	0	0	0
Doctor of Philosophy	37	37	37	37	30	46	37	39	21	50	45	47	28
John Molson School of Business	**115**	**227**	**134**	**249**	**102**	**250**	**69**	**191**	**243**	**273**	**163**	**281**	**107**
Certificate - Graduate	8	43	10	32	16	41	6	25	3	34	13	29	9
Diploma - Graduate	56	46	82	61	25	55	19	55	110	79	106	106	28
Master of Business Admin	30	116	19	119	34	120	23	74	104	112	20	105	20
Master of Bus. Admin - COOPs	4	7	8	5	3	6	6	7	6	19	9	8	21
Master of Science	14	9	11	25	21	25	7	26	14	19	14	25	27
Master of Supply Chain Mgmt	0	0	0	0	0	0	0	0	0	1	0	1	0
Doctor of Philosophy	6	6	4	7	3	3	8	4	6	9	1	7	2
Total Graduate	**1033**	**1041**	**698**	**1121**	**661**	**1245**	**727**	**1146**	**880**	**1260**	**926**	**1456**	**832**

Expected Grad. Term	2131	2134	2141	2144	2151	2154	2161	2164	2171	2174	2181	2184	2191
Convocation in	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018	Fall 2018	Spring 2019	Fall 2019
UNDERGRADUATE	**1111**	**4256**	**929**	**4208**	**910**	**4305**	**876**	**4347**	**852**	**4490**	**964**	**4493**	**915**
Faculty of Arts & Science	**535**	**2000**	**442**	**2023**	**431**	**1986**	**396**	**2024**	**378**	**2076**	**407**	**1975**	**424**
Bachelor of Arts	428	1632	363	1612	347	1616	295	1583	289	1586	307	1525	322
Bachelor of Arts - COOPs	5	11	0	9	1	11	5	11	1	11	3	19	3
Bachelor of Education	7	26	7	36	4	25	7	16	2	41	5	39	5
Bachelor of Science	76	294	55	321	62	281	70	366	71	395	77	351	81
Bachelor of Science - COOPs	0	8	0	15	0	11	1	14	1	19	0	22	2
Certificate - Undergraduate	19	29	17	30	17	42	18	34	14	24	15	19	11
Faculty of Fine Arts	100	497	107	419	105	487	83	511	76	471	97	**501**	**87**
Bachelor of Fine Arts	98	497	106	419	104	481	82	507	76	467	97	501	87
Bachelor of Fine Arts - COOPs	2	0	1	0	1	6	1	4	0	4	0	0	0
Gina Cody School	61	501	38	554	45	502	66	550	73	665	80	**708**	**85**
Bachelor of Computer Science	17	58	8	86	11	66	16	98	14	90	21	106	24
Bachelor of Comp Sc - COOPs	4	12	3	9	3	12	1	8	3	14	4	9	4
Bachelor of Engineering	36	369	22	383	28	354	41	361	44	452	50	464	50
Bachelor of Engineering-COOPs	4	62	5	76	3	69	8	83	12	108	5	129	7
Certificate - Undergraduate	0	0	0	0	0	1	0	0	0	1	0	0	0
John Molson School of Business	**411**	**1232**	**329**	**1180**	**326**	**1279**	**324**	**1258**	**324**	**1277**	**379**	**1309**	**319**
Bachelor of Administration	36	99	32	87	30	82	16	57	17	25	5	15	3
Bachelor of Commerce - COOPs	23	100	28	92	24	101	24	106	26	112	25	102	24
Bachelor of Commerce	338	1019	257	989	270	1086	277	1080	275	1128	342	1180	285
Certificate - Undergraduate	14	14	12	12	2	10	7	15	6	12	7	12	7
School of Extended Learning	**4**	**26**	**13**	**32**	**3**	**51**	**7**	**4**	**1**	**1**	**1**	**0**	**0**
Compl Univ Credit Certificate	4	26	13	32	3	51	7	4	1	1	1	0	0
Total Undergraduate	**1111**	**4256**	**929**	**4208**	**910**	**4305**	**876**	**4347**	**852**	**4490**	**964**	**4493**	**915**

Concordia University
Graduation Statistics – Overall by Faculty - Fall 2019
As of 2020-09-30

	2181 Fall 2018	2191 Fall 2019	Difference
Faculty of Arts & Science	**639**	**637**	**-2**
Bachelor of Arts	307	322	15
Bachelor of Arts - COOPs	3	3	0
Bachelor of Education	5	5	0
Bachelor of Science	77	81	4
Bachelor of Science - COOPs	0	2	2
Certificate - Undergraduate	15	11	-4
Diploma - Graduate	46	44	-2
Doctor of Philosophy	31	23	-8
Master of Arts	105	115	10
Master of Arts - COOPs	2	0	-2
Master of Science	40	27	-13
Master of Teaching of Math	1	0	-1
Masters of Environment	7	4	-3
Faculty of Fine Arts	**164**	**162**	**-2**
Bachelor of Fine Arts	97	87	-10
Diploma - Graduate	8	13	5
Doctor of Philosophy	5	7	2
Master of Arts	44	48	4
Master of Design	3	0	-3
Master of Fine Arts	7	7	0
Gina Cody School of Engineering & Computer Science	**543**	**521**	**-22**
Bachelor of Comp Sc - COOPs	4	4	0
Bachelor of Computer Science	21	24	3
Bachelor of Engineering	49	49	0
Bachelor of Engineering-COOPs	5	7	2
Certificate - Graduate	5	4	-1
Diploma - Graduate	26	15	-11
Doctor of Philosophy	45	28	-17
Master of Applied Comp Science	14	38	24
Master of Applied Science	73	53	-20
Master of Computer Science	7	15	8
Master of Engineering	294	284	-10
John Molson School of Business	**542**	**426**	**-116**
Bachelor of Administration	5	3	-2
Bachelor of Commerce	342	285	-57
Bachelor of Commerce - COOPs	25	24	-1
Certificate - Graduate	13	9	-4
Certificate - Undergraduate	7	7	0
Diploma - Graduate	106	28	-78

Doctor of Philosophy	1	2	1
Master of Bus. Admin - COOPs	9	21	12
Master of Business Admin	20	20	0
Master of Science	14	27	13
School of Extended Learning	**1**	**0**	**-1**
Compl Univ Credit Certificate	1	0	-1
School of Graduate Studies	**1**	**0**	**-1**
Certificate - Graduate	1	0	-1
Total	**1890**	**1746**	**-144**

CONCORDIA UNIVERSITY

Fall 2019

THE GOVERNOR GENERAL'S GOLD MEDAL – TECHNOLOGY, INDUSTRY AND THE ENVIRONMENT

Conferred by Her Excellency, the Governor General of Canada

Alireza Haghighatmamaghani, PhD (Spring 2019)
Department of Building, Civil and Environmental Engineering
Gina Cody School of Engineering and Computer Science

Thesis Title

Hydrothermal/Solvothermal Synthesis of Hierarchical Titanium Dioxide

Supervisor

Dr. Fariborz Haghighat
Professor, Department of Building, Civil and Environmental Engineering

CONCORDIA UNIVERSITY – FALL 2019

THE GOVERNOR GENERAL'S SILVER MEDAL

Conferred by Her Excellency, the Governor General of Canada, and awarded to the highest ranking undergraduate student graduating from Concordia University.

PRIZE WINNER

Student Name	Degree and Concentration(s)
Collin Therrien, Philippe	BSc Specialization Biology

N.B. Only Concordia University courses (and Quebec Interuniversity courses taken since the Summer 1997 academic term) are included in the calculation of the Prize GPA.

UNIVERSITÉ
Concordia
UNIVERSITY

US-2020-5-D12

ACADEMIC PLANNING AND PRIORITIES COMMITTEE
REPORT TO SENATE
Dr. Anne Whitelaw
October 16, 2020

The Academic Planning and Priorities Committee met on October 1, 2020.

The Academic Planning and Priorities committee (APPC) met on October 1, 2020. Dr. Nadia Bhuiyan, co-Chair of the ad hoc committee on internships gave a presentation on the document entitled *Internship Study at Concordia University*. She explained the background of the mandate of the committee, the definition of internships and the methodology of the research into creating the comprehensive report. Dr. Bhuiyan also outlined the recommendations and conclusions from the report. The committee appreciated the findings and supported the recommendations of the study.

The presentation of the document entitled *Internship Study at Concordia University* will take place at the Senate meeting on October 16, 2020.

EXTRACT OF THE MINUTES OF THE MEETING OF SENATE HELD ON APRIL 20, 2018

R-2018-3-13 Whereas internships represent an invaluable hands-on learning experience for students;

Whereas internships exemplify Concordia University's direction towards broader engagement with students' respective fields as well as more global and experiential learning opportunities;

Whereas there exists a large disparity in the criteria, objectives, learning outcomes and evaluation methods of internships, as well as a significant imbalance in remuneration for students' labour; and

Whereas internship courses should have the same standards of learning, evaluation and support as other academic courses;

BE IT RESOLVED:

That the Academic Planning and Priorities Committee be mandated to:

1. Evaluate internships at Concordia;
2. Make recommendations to standardize internships;
3. Review internal policies; and
4. Produce regular reports to Senate on its progress; and

That these objectives be met within two years.

INTERNSHIP STUDY AT CONCORDIA UNIVERSITY

Submitted by the APPC ad hoc subcommittee on reviewing internships

Co-Chairs
- Nadia Bhuiyan (Office of the Provost)
- Sandra Gabriele (Office of the Provost)

Associate Dean, Academic Programs and Development
- Brad Nelson (SGS)

Faculty members
- Brigitte Jaumard (GCS)
- Luigi Allemano (FOFA)
- Kristina Huneault (FOFA)
- Saul Carliner (FAS)

Staff
- Louise-Anne Côté (CMS)

Graduate student
- Rashmikaa Sethu Madhavan

Undergraduate Students
- Mikaela Clark-Gardner
- Marguerite Rolland
- Colin Philip

Contributor
- Alice Isac, Lead, Experiential Learning (Office of the Provost)

Secretary
- Andrea Renaud, University Secretariat

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Experiential learning (EL) is learning by doing: it involves a concrete experience, followed by reflection, abstraction, experimentation, and loops back to a concrete experience. This is a process that results in optimal learning outcomes. The active engagement of the student in the learning experience better prepares them for life after graduation by enhancing knowledge and skills. Concordia offers a vast array of EL opportunities to students through in-class learning, work-integrated learning (WIL), research-integrated learning, community-based learning, international learning, and co-/extra-curricular learning. Internships are a popular form of WIL that are valued by students, companies, community partners, and government.

At Concordia University, there are 387 undergraduate programs and 141 graduate programs. Of these, 155 programs have internships. Over 4,100 students benefit from co-op placements and internships.

While the benefits of internships are highly appreciated by students at Concordia, they have expressed the following concerns: no standard of learning, evaluation or feedback; inconsistencies in remuneration and criteria; and financial precarity and the potential for exploitation. As such, in the fall of 2018, the Academic Planning and Priorities Committee (APPC) was mandated by the Senate to conduct a study on internships at Concordia. A subcommittee was formed to undertake the study.

Primary data about the Concordia community was gathered through two surveys. The first was a survey of the experiences of internship support faculty/staff. A second survey was sent to all students in order to better understand their experiences of experiential learning at Concordia. An ongoing study conducted by the Ministère de l'Éducation et de l'Enseignement supérieur (MEES), in conjunction with a study undertaken by the Bureau de coopération interuniversitaire (BCI) on internships, also provided valuable data about internship programs. We have received feedback from the government on offering solutions and recommendations.

Results show that at Concordia:

34 academic departments and units offer internships.	The objectives of the internship are most often to apply skills (75% popularity score).
230 internship courses are offered.	88% of internships provide academic credits, most provide 3 credits (66%).
Internships range from 16-1680 hours: most internships are between 100 to 200 hours (31%) or over 1000 hours (28%).	54% of internships are paid, and 11% provide some other form of financial support or compensation.
32% of internships are co-op.	Payment ranges from $0-$30 an hour.
52% of internships are mandatory (not including co-op, which are all optional).	

While 91.5% of student respondents who have already completed an internship believe that their internship was effective in fostering a learning experience that was relevant to their program, almost 50% of the total respondents feel a great deal of financial stress, and in general, approximately one-third of students did not feel adequately supported by faculty, staff and host organizations in the process.

The results show that, while key elements of success in the design and delivery of internships are present, there is room for improvement. This can be done by providing a standardized set of requirements that is clear to students, faculty/staff and host organizations. Several opportunities emerged for improving the quality of the student experience, the quality of support provided by faculty and staff that are responsible for the internships, and for the host organization.

The key elements to a successful internship, as rated by students and faculty and staff, are highlighted below:

Students	**Faculty and Staff**
Clear job description and expectations (75.4%)	Site supervisor (71.4%)
Coordination between academics and the job-site (69.4%)	Learning objectives (61.9%)
Clear instructions on workplace requirements (66.9%)	Providing feedback to students (61.9%)
Prospects for future employment (66.3%)	Clarity of expectations (52.4%).
Feedback for students (62.5%)	Coordination between the university and employer (42.9%)
Compensation (62.5%)	Required qualifications (42.9%)

The following recommendations are made based on the data collected:

Pedagogical Support and Guidance for Internships

- Create a standard internship agreement.
- Scope internship appropriately.
- Articulate internship prerequisites and conditions.
- Clearly define learning outcomes and reflective exercises.
- Provide effective feedback.
- Clarify roles and responsibilities of students, faculty/staff, and host organization.
- Increase internship opportunities for students.
- Conduct evaluations of the internship experience.
- Provide information and create awareness of workplace protections.
- Develop a guidebook to assist students, faculty/staff and host organizations.
- Promote and increase skills development offerings to better prepare students for the transition into their EL experiences.
- Offer language courses.

Financial Assistance

- Increase and promote awareness of remuneration and financial support (improved government assistance) and continue to look for financial assistance (grants, donors, internal support, alumni, etc.).

Faculty and Staff Support

- Increase resources and support to allow for better design and delivery of internships.
- Leverage internal resources to increase support.

A detailed discussion of our findings and associated recommendations is presented in this report.

1.0 INTRODUCTION

Experiential learning (EL) has been recognized and validated as a valuable component of a 'next-generation' learning experience. Experiential learning is learning by doing: students undertake a concrete experience, followed by reflection, abstraction, experimentation, and loop back to a concrete experience. It is a process that results in optimal learning outcomes. In 2019, the Canadian University Survey Consortium surveyed 46 universities across Canada, and over 18,000 first year university students indicated that the second reason for their choice of university was that it offered co-op, practicum, or other work experiences (their program of choice being available was ranked number 1). To highlight the importance of EL, the 2019 federal budget is investing a total of $798 million towards 84,000 work-integrated learning placements by 2023-2024.

Experiential learning gives students the unique opportunity to contextualize what they learn in class, and helps them to absorb, retain and apply knowledge in a way that is more profound than a traditional lecture-based course. The active engagement of the student in the learning experience better prepares them for the workforce or community-based work, enhancing knowledge, professional and transferable skills (such as communication, critical thinking, problem-solving, lifelong learning etc.), and attitudes (increased self-esteem, leadership, motivation, engagement in school and at work). These competencies help students build their resumes and networks, and allow them to better realize their career aspirations.[1]

1.1 Experiential Learning at Concordia University

There is a wide range of models that incorporate EL within real world contexts. Concordia offers a broad array of EL opportunities to students, which are categorized as follows: in-class learning, work-integrated learning (WIL), research-integrated learning, community-based learning, international learning, and co-/extra-curricular learning. Internships are a popular form of WIL that are valued by students companies, community partners, and government. At Concordia University, there are 387 undergraduate programs and 141 graduate programs. Of these, 155 programs have internships. Over 4,100 students benefit from co-op placements and internships.

1.2 Internships in Quebec

Over the past few years, unpaid internships have become a prime area of focus in Quebec, particularly for programs where they are required; students have mobilized to eliminate them, citing exploitation, and financial and emotional challenges as some of their motivations. Furthermore, companies, government departments, or community partners with limited resources often take on interns for free, but they put themselves in a precarious situation since unpaid interns are not considered 'employees' and therefore are not protected by the federal and/or provincial employment rules and regulations that apply to employees.

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[1] Kolb, D. A. (1984). Experiential Learning: Experience as the Source of Learning and Development. New Jersey: Prentice-Hall.
Jackson, L. & Caffarella, R.S. (1994). Experiential Learning: A New Approach (pp. 5-16). San Francisco: Jossey-Bass.
Moon, J. (2004). A Handbook of Reflective and Experiential Learning: Theory and Practice. London: Routledge Falmer.

Even if some students are willing to work without pay in order to make themselves more marketable upon graduation, they may be putting themselves at risk. *Québec's An Act Respecting Labour Standards* defines an employee as a "person who works for an employer and who is entitled to a wage"[2]. Unpaid internships are not allowed in Québec unless the internship falls under one of the three exemptions detailed in the Act: when it is part of an academic program; if it is volunteer work done in a nonprofit organization; or as part of a vocational training program. Students are pushing to change this and to have all internships paid.

1.3 Motivation for the Study

While the benefits of internships are highly appreciated by students at Concordia, concerns centre on the lack of a standard for learning objectives, evaluation or feedback, inconsistencies in remuneration and criteria, financial precarity, and the potential for exploitation. As such, in the fall of 2018, the Academic Planning and Priorities Committee (APPC) was mandated by the Senate to conduct a study on internships at Concordia University at the request of students. An ad-hoc subcommittee was subsequently formed to study the situation at Concordia.

Within a timeframe of two years, the objectives of the subcommittee were to:

- Evaluate internships at Concordia
- Make recommendations to standardize internships
- Review internal operating procedures and guidelines
- Produce regular reports to Senate on its progress

The subcommittee on internships is composed of the following members: Vice-Provost, Partnerships and Experiential Learning and Vice-Provost, Innovation in Teaching and Learning (co-chairs), 2 Faculty members, 2 students selected from APPC membership, 1 staff member who has experience in managing internship programs, and the Associate Dean of Academic Programs and Development from the School of Graduate Studies.

At approximately the same time as our study began, on November 19, 2018, the Ministère de l'Éducation et de l'Enseignement supérieur (MEES) began a study on internships in universities in order to have a global understanding of the nature of internships, as well as of the number of students undertaking internships. On October 5, 2018, the Bureau de coopération interuniversitaire (BCI) also created a working group, Groupe de travail sur la Rémunération des stagiaires universitaires (GT-RSU), to look more specifically at unpaid internships. The MEES and the BCI therefore combined efforts to undertake the data collection activity. There were three parts to the study which required a collection of data and information on internships.

Because of the timelines and relevance of our study and that of the Ministry, we include in this report results and recommendations from both studies. The report therefore presents issues related to student retention and student success, accessibility to studies, and the quality of the student intern experience, and presents corresponding solutions and recommendations.

[2] *Source: https://mcmillan.ca/Managing-Unpaid-Internships-in-Quebec*

2.0 INTERNSHIPS DEFINED

Student internships are an important part of many programs at Concordia. There is a wide range of internship types. These have been classified by the MEES as internships involving 1- observation, 2- gaining and developing knowledge or 3- applying skills. The internship may take place in the public service, private companies, community organizations or business/training schools, and may last from a few days to several months. Internships can be for credit or not-for-credit, part-time or full-time.

An internship is a recognized part of an academic program (i.e. it appears in the academic calendar). An internship has several requirements:

- Learning objectives
- Reflective learning assignments
- Internship report or presentation (graded by a supervisor from the program)
- Supervision
- Evaluation

It is important to properly define an internship as it will have implications on various levels. For students, it ensures that they receive staff support by the academic institution, obtains recognition of the internship on the transcript, and is protected through insurance and liability of the university and CNESST. For the employer or host organization, there are clear requirements regarding the internship, a shared liability of the internship experience, a specific match to qualifications required for the internship, a tax credit allocation, and administrative and academic support for the internships. Similarly for the university, there are clear requirements regarding the internship, a shared liability of the internship experience, and funds are available through the government for accredited internships.

For purposes of this study, we defined an internship as:

“The position of a student or trainee who works in an organization (paid or unpaid) to gain work experience, or to satisfy requirements for a qualification, or to share expertise in service to the community.”

More recently, the MEES defined an internship as follows:

“Un stage étudiant consiste en une formation ou un apprentissage pratique, répondant à une intention pédagogique, qui est supervisé et qui permet l’observation, l’acquisition ou la mise en œuvre de compétences dans un contexte de travail.”

According to the MEES, an internship:

- is an experiential learning activity that contributes to the training of the student;
- consists of focused learning objectives which are evaluated by a member of the academic institution (professor, person in charge of the training program, etc.), and/or by someone at the host organization qualified to evaluate the student’s work.

3.0 METHODOLOGY

The committee met five times over the course of a year and a half, and established criteria for successful internships and conducted two surveys: one survey of the experiences of internship support faculty/staff and one university-wide study of students' internship experiences.

Table 1 shows the criteria, and corresponding inputs and outputs where applicable, that were identified as being the most important that lead to positive student outcomes.

Table 1. Criteria for Successful Internships

Criteria	Inputs	Outputs
Coordination between academics/job-site	Application process	Reports
Job description	Interviews	Presentations
Required qualifications	Training	Reflection report
Defined learning objectives	Exams	Experience gained
Compensation: monetary	Skills development opportunities	Internship project deliverables
Supervisor role (faculty)	Website/database	Training received
Supervisor role (site)	Networking opportunities	Networks developed
Clear articulation of internship expectations	Negotiations on the terms of the agreement	Agreement
Staff coordination	Survey	
Duration		
Credits toward degree		
Autonomy		
Task clarity		
Feedback mechanisms for students		
Evaluation: Pass/Fail/Grade		
Workplace requirements		
Liability Insurance		
Standardization of paperwork		
Resource support		
Conflict resolution process/procedures		
Relationship to program: mandatory/non-mandatory		
Location		
Prospects for future employment		
Inclusive practices (accommodations)		

3.1 Faculty and Staff Survey

In the winter semester of 2019, a staff and faculty survey was circulated to internship and program coordinators for programs with an internship component, including co-op. While the study focused on for-credit internships only, the committee was also interested

in gathering data on how co-op programs handled various aspects of internships. The survey asked questions about Academic Relevance and Quality Assessment, and Remuneration and Support.

Thirty-six departments were contacted, and 21 responses were received. The following three questions were added to the list of questions for the BCI study that were circulated to departments and units with internships:

1. Is there an application or selection process? (Yes/No)
2. List all the types of support you provide to students engaged in an internship placement (i.e.: job bank, remuneration, supervisor consultations, supervisor check-in during internship etc.)
3. Is language a barrier to students finding or being placed in viable internships? (Yes/No)

Responses to these questions addressed 164 internship courses across the university. The analysis of qualitative data for Question 2 was developed by a search and tally of popular terms. Frequency is prioritized over the context of the response; however, in most cases the responses contained a short list of terms rather than a detailed phrase. Thus, the percentages are a popularity rating in relation to the other answers for the same question.

3.2 Student Survey

In the fall of 2019, the committee developed and completed an anonymous student census survey to assess the experiences and perceptions of students regarding internships. Students were asked questions related to Demographic Profile, Socioeconomic Profile, Living Arrangements, Program Factors, Financial Factors. This survey was administered and analyzed by the Office of Institutional Planning and Analysis via email and the survey was promoted online through University Communications Services. To increase the response rate, we put forward an incentive of winning one of three $250 gift cards for the Concordia bookstore selected by a lucky draw among survey respondents. All full-time and part-time students that were enrolled in a program during the Fall 2019 semester were invited to participate (35,801 students). A total of 2524 students completed the survey, yielding a response rate of 7.1%, with a ± 1.9% margin of error at a 95% confidence interval.

Several survey questions allowed for open-ended, qualitative responses if the participants selected the “other” option within that question. A qualitative analysis of these responses was conducted by coding each answer based on the context to more accurately represent the respondent’s opinion. Short responses that focused on a single issue or topic were coded once, while longer responses that touched on multiple topics were coded multiple times. For example, if a student had mentioned a concern about both finances and job security, this single response would be coded twice (once for finances and once for job security). Thus, the total number of coded responses may exceed the actual number of responses for that question. This means that the analysis of these questions reflects a ranking of how frequently the topic was mentioned in a response.

3.3 Government Study

The Ministère de l'Éducation et de l'Enseignement superieur (MEES) conducted a study in 2019, comprised of three phases: Phase 1: creation of an inventory of internship programs and classifying internships[3] (January 2019); Phase 2: data collection on all internships, mandatory and optional, and including information about programs (March 2019); Phase 3: data collection involving qualitative questions around internships (April 2019).

Phase 1

The first phase of the study involved creating an inventory of internship programs and classifying internships (only mandatory internships were included in this phase). Institutions were asked to collect data on undergraduate and graduate programs. Concordia was asked to submit data for only the following programs: social services, education, engineering, computer science, math, accounting, and administration.

In this phase, information on the following was collected on all *mandatory* internships:

- Faculté
- Description officielle du stage
- Département ou école
- Durée du stage (nombre d'heures)
- Code du programme
- Modalités du stage
- Nom du programme
- Moment où le stage survient dans le programme (session)
- Nombre de crédits du programme
- Nombre de sessions sur lesquelles le stage s'échelonne
- Durée du programme (nombre de sessions)
- Nombre de crédits rattachés au stage
- Code du stage
- Stage offert selon le régime coopératif
- Nom du stage
- Milieu où le stage se déroule le plus souvent
- Objectif du stage
- Rémunération ou compensation financière du stagiaire
- Rémunération ou compensation: montant versé au stagiaire

The MEES asked all universities to provide the requested data via the BCI by the 19th of January, 2019. On January 19, 2019, the MEES released its work plan which would allow the Ministry to propose satisfactory solutions for internships and therefore address the concerns of stakeholders, mainly those of students.

Phase 2

The second phase of the study required data collection on all internships, mandatory and optional, and called for more details about programs. Data for this phase was to be submitted via the BCI by March 15, 2019. In this round, we had a higher response rate. The Experiential Learning Office coordinated this task by asking 35 departments and units, including the Institute for Cooperative Education, to report on the internships that they offer within their programs. Since programs vary in nature, this inventory includes majors, honours, specializations and diplomas in order to minimize duplicate reports of the same internship course. As these responses cover all internships, there are variations within internships in a specific program or department. For example, a department may have several different internship courses listed; however, they may not all be paid.

[3] Only mandatory internships were included in Phase 1.

Phase 3

Finally, in a third phase in April, 2019, universities were asked to answer qualitative questions around internships. The Ministry presented issues drawn from previous phases of the study related to student retention and student success, accessibility to studies, and the quality of the student intern experience, and offered corresponding solutions and recommendations in two streams, namely financial assistance and pedagogical support and guidance required for internships.

The Ministère met and communicated with relevant stakeholders, including Concordia's Office of the Provost, to conduct the study. This included:

- Meetings with student associations
- Meetings with college and university administrators
- Meetings with other government departments involved with internships
- Meetings with labour market stakeholders.

3.4 Challenges/Limitations of the Concordia Study

Faculty and Staff Survey

Thirty-five departments were contacted, and 21 responses were received; however, the response rate is difficult to discern from this anonymous survey. The benefits of an anonymous survey for this group includes encouraging participation and honesty in responses; however, in many cases there are multiple individuals within a department that manage and coordinate different internships and courses. In addition, the survey was sent widely to the respective chairs, departmental assistants and internship coordinators to increase the chances that the appropriate person(s) would be notified and that they would complete the survey. This speaks to the complexity of communications and information gathering for evaluations in the University context, as well as the complexity of the management of the internship process. This also demonstates the ad hoc way that internships have grown across the University, without a standardized way to support their administration, the different ways they are included in the curriculum, and the different resources available to different units.

The survey request was also combined with a time sensitive request from the MEES for the same departments and units to compile a detailed report on internships (the results of which are included in this report). As a result, some of the requested participants may not have had the time to complete the survey or else they may have overlooked it.

Student Survey

We aimed to give all students the opportunity to express their views. As such, the low response rate may be because this was a census survey. Yet, the low margin of error and relatively high confidence interval illustrate the greater extent to which the survey data may accurately reflect the views of the larger target population.

The department or program information was not collected for the respondents of this survey, although this question was listed in the first version of the survey. As we consulted with support units at Concordia University, we were advised to reduce the number of questions. The program or department question was removed as we were told we could obtain this information from the student information system; however,

when we later decided to make the survey anonymous, we overlooked the fact that by doing so, we would no longer be able to connect the responses to student data.

Concordia BCI Study

A number of respondents reported that the internship courses offered by their program had too much variation to provide the specific answers requested by the MEES. For example, the objectives could vary between observation, application, and acquisition of skills; the sector could vary from private, public, to community; remuneration could vary depending on the employer; etc. The respondents were advised to select the responses that would apply to most internships that students undertake for that course. As a result, there is much more variation in the internships than is captured in this inventory of internship courses.

4.0 RESULTS AND ANALYSIS

In this section, we present the findings of the two surveys and present some results from the government study.

4.1 Faculty and Staff Survey

The faculty and staff survey was administered from March 5 to 29, 2019. A total of 35 departments were contacted, and 21 responses were received; however, the response rate is difficult to discern from this anonymous survey. Most of the survey questions were open-ended. As a result, many of the responses were coded manually into themes. A detailed list of questions and results can be found in Appendix B of this report. In addition, the statistics collected below often reflect questions that allowed for multiple responses, which means that the percentages reflect a ranking or degree of popularity for the responses.

4.1.1 Academic Activities and Conditions

In this section, we gauge how closely the internship was aligned with its program.

Placement coordinators within academic programs ensure alignment between the program objectives and the internship placement; in cases where students have found their own placement, coordinators review the details of the student's internship application, and also ask the student to explain how the internship is relevant to their program (including learning outcomes). Ninety percent of the respondents provide learning objectives for the internship; they also provide guidance on these mainly through documentation (syllabus, forms, handbook); posting information on a content management system (CMS), a learning management system (LMS) or website; and finally through verbal instructions in a classroom setting. While this is a significant accomplishment in defining outcomes, and in aligning expectations for students, faculty, and supervisors, the quality and specificity of these objectives is unknown. Learning objectives that are not clearly defined may create too much nuance around the scope of the student's work and set unrealistic expectations for the host organization around what the student can accomplish during their internship experience.

Ninety percent of the respondents also monitor the student's experience during the internship, through periodic touchpoints with the site supervisor and the student; however, it is unknown how often this occurs, and the extent to which a follow-up is sufficiently carried out to address the students' needs and concerns and to provide appropriate feedback. Moreover, the extent to which the parties listed below are available to provide support is unknown.

The relevance of the student's experience is assessed mostly through written reports and supervisor evaluations; presentations, academic evaluations, site visits and student consultations are less common options.

The key elements that the respondents believe make an internship successful are:

- Site supervisor (71.4%)
- Learning objectives (61.9%)
- Providing feedback to students (61.9%)
- Clarity of expectations (52.4%)
- Coordination between the university and employer (42.9%)
- Required qualifications (42.9%)
- Evaluations (38.1%)

When asked how departments maintain or develop partnerships with host organizations, respondents answered that a staff member is often devoted to this task, through the submission of student proposals for securing the internship, networking, alumni connections, events and frequent communication.

4.1.2 Internship Prerequisites and Conditions

A minimum GPA is the most common prerequisite for an internship (76.2%), followed by academic prerequisites (66.7%). An appropriate skillset is half as common (38.1%), followed by language (33.3%) and full-time status (33.3%). The reasons for these requirements are mainly student preparedness, however alignment between the program and the internship, department standards and other regulatory bodies are also factors. Also, 66% of the internships include an application and selection process. For 48% of internships, language is not considered a barrier for students in securing an internship; however, only 29% of these internships did not cite language as a barrier, 4% indicated that it was sometimes, and 19% did not have a response.

Given that the development of 21st century skills is increasingly important, educational institutions are working to bridge the gap in student preparedness for working in their field of study.[4] This is but one of many reasons why internships are so crucial to easing the transition between one's academic and professional career. Indeed, students who have already completed an internship (40% of respondents in student survey) ranked skills development as the second highest advantage of internships (paid and unpaid).

Most respondents indicated that their department was flexible in allowing a part-time or full-time internship options (61%).

4.1.3 Skills Development

Respondents were asked to indicate which skills were captured through the internship before, during and after the internship is undertaken. Table 2 shows the results.

Table 2 Skills captured during internship process.

Before the internship	During the internship	After the internship
- Communication (80%) - Decision-making (70%) - Self-awareness - Initiative and self-direction (60%)	- Communication (90.5%) - Decision-making (85.7%) - Leadership and collaboration (90.5%)	- Reflection and articulation of learning (94.7%) - Decision-making (68.4%) - Self-awareness (68.4%)

4.1.5 Remuneration and Support

When asked if the program allowed for students to undertake unpaid internships, the most common response for the rationale was that remuneration for students depends greatly on the host organization's offer. This is followed by stating that the learning process or gaining experience over remuneration is the priority, followed by the fact that

[4] The coming skills revolution: Humans Wanted, How Canadian youth can thrive in the age of disruption. The RBC Future Skills Report.

students are awarded course credits. Seventy-six percent of respondents also report that they have observed a relationship between remuneration and the retention of students, and that students are more likely to stay in the program if they are paid for an internship.

When asked about the rationale for unpaid internships, there is a perceived loss of control over the student's tasks if the internship is paid, or a lack of funds to pay them.

Staff and faculty respondents report that they do not have enough staffing or resources to find and promote internship opportunities, and this is but one area of support that they provide to students. This corroborates verbal feedback we received during internship coordinator meetings (that were not part of this survey) where coordinators indicated their desire to offer more support to students but were limited in their capacity due to resource constraints. Moreover, in many cases the coordinator for the internship program is a faculty member, also with only limited time and other resources. At times there can be a loss of institutional memory when the faculty member completes his/her term and passes on the internship coordinator duties to a new member, who will have to spend time in determining his/her own administrative processes, creating relationships with external partners and navigating the university's services.

Check-ins, consultations, and supervision are the most common form of support provided to students (52%), followed by a course, class, or seminar (16%) and site visits (11%). Conflicts do not often arise internally with students who contest their internship placements (note that most respondents answered this question in relation to the example listed, i.e., students contesting their placement) (only 15% reported at least one conflict in the past year); however, it is often staff that intervene and provide support to students when this occurs.

4.2 Student Survey

All the questions in this survey were optional except for the following two required questions:

1. Is an internship required for your academic program?
2. Have you already participated in an internship while studying at Concordia?

In addition, two skip rules were applied in order to allow students who did not have a mandatory internship component as part of their program and students who have not yet completed an internship to skip those questions.

Several questions allowed for the selection of multiple responses. As a result, these statistics do not reflect the views of a percentage of total respondents. Instead, they reflect a popularity rating for the selections that were made within that question.

4.2.1 Demographic Profile

The student survey showed that 69.3% of the respondents belonged to an employment equity group as defined by the Government of Canada or identified as non-binary or as having another gender identity, and 58.9% identified as woman[5]. This means that the

[5] The first two questions in the survey were on gender and employment equity groups. The data was merged as in some cases, the gender was disclosed in the first question but not in the second question. See the Appendix C for the detailed questions.

data we have collected largely represents this population. Note that there are intersections within the groups below (for example there may be women who also identify as visible minorities). This is to say that the groups are not mutually exclusive.

Employment equity group status	
Woman	58.9%
Non-binary or Another gender	0.8%
Aboriginal Peoples	1.6%
Persons With Disabilities	3.6%
Visible Minority	21.1%

Nearly all respondents were able to both fluently speak (95.6%) and write (96.6%) in English, while only half were able to fluently speak (51%) and write (49.25%) French. This poses a significant challenge to non-French-speaking students in securing an internship in Quebec.

4.2.2 Socio-Economic and Financial Profile

Results show that 66.6% of the respondents work while they are studying and only 32.8% do not work at all. Of the students that do work, 32.2% work between 11-20 hours, 19.8% work 1-10 hours, and 14.6% work more than 20 hours.

When asked about their financial responsibilities, they were able to select multiple answers. The most popular answers were transportation costs (79.1%), course materials (74.7%), and tuition (74.5%), followed by living expenses (65.5%).

All respondents were asked to rate the level of financial stress they experience during their studies: 46.2% report feeling a great deal of stress while 14.3% report some or little stress, 6.7% feel none and 2.1% did not respond.

4.2.3 Internship Experience

For 40.3% of respondents, an internship is a requirement for their academic program. This means that the survey responses provide a relatively balanced mix of perspectives on internships from students who must complete an internship and those who are not required to do so. Of those who must complete an internship, 38.3% have already participated in at least one internship while studying at Concordia.

The following information pertains specifically to those who have already participated in an internship while studying at Concordia (15.4% of total respondents and 38.3% of respondents with a required internship).

Students were asked to provide information on up to four internships in which they have participated. Below is a summary of their responses:

- 43.5% of all reported internships were paid
- 89.4% were mandatory
- 77.1% were for credit

Of the internships that were for credit (77.1%): 30.8% were also paid, 67.1% were unpaid, 94.5% were mandatory, and 2.5% were optional. Of the internships that were not for credit: 78.2% were paid, 15.6% were not paid, 61.5% were mandatory and 30.2%

were optional (See Appendix C for more details). While it may seem counter-intuitive for an internship to be both mandatory and not for credit, it is important to note that this could describe an internship that is offered by the Institute for Cooperative Education.

Almost half of the students (49.5%) believe that the internship requirements were proportionate to the number of credits received, while 22.9% disagreed (this can imply that they either feel that the effort involved was higher than expected, or that they did not do as much as they expected) and 27.6% said this was not applicable. Even though only half of the students who have already completed a mandatory internship believe that the internship requirements were proportionate to the number of credits received, 91.5% do believe that their internship was effective in fostering a learning experience that was relevant to their program. This could be due to the host organization's culture, the on-site supervisor's expectations of the student's scope for the internship, or the student's perception of how much effort they should devote to the internship.

4.2.4 Support

Those who were required to participate in an internship report that the following supports exist for their program: supervisor/staff support (21.9%), networking opportunities (20.5%), skills development (19.3%), and access to a job bank (18.5%). The qualitative answers provided in the "other" category (4.6%) showed that 76.2% of these respondents agreed that their program provided some form of support, and the top answer was support in finding or being placed in an internship (32.6%). Additionally, a considerable number of these students (19.8%) indicated they do not receive any support from their program.

When asked to rate the quality of support that they received during the internship, students used a Likert scale which included an acceptable range of responses (Good or Excellent) to an unacceptable range (Poor, Fair, or Average). The ratings for each group are summarized below (a detailed summary is provided in the appendix). A satisfactory range for an acceptable rating should be 80% or more; however, there is an area of improvement that ranges between 16.5% to 33.1% across the board. This demonstrates a gap between the students' needs and expectations of the members of their support system, and the quality of support that each party would like to provide to students. These responses are subjective; the student's reasoning is unknown.

Degree of Quality	Department	Professor	Supervisor	Site Supervisor
Acceptable	57.5	46.9	63.5	60.8
Unacceptable	37.0	29.3	28.4	28.5

4.2.5 Finances

Almost 41% of respondents incurred significant travel costs as part of the internship, but only 4.7% had their expenses covered by their program. These respondents have varied sources of financial support for the expenses that they had or will have during an internship. Participants were asked to select all the sources available to them and so there are intersections in their answers. The most popular answers are personal savings (22.2%), family support (21.3%) and work income (20.9%), followed by bursaries or scholarships (17.2%) and loans or lines of credit (15%). This question included an "other" option; however, less than 1% of respondents selected this option (approximately 20 responses) and they generally fell into the previously mentioned categories. In other words, no new or substantial insights were gleaned from the qualitative analysis of this section.

4.2.6 General Perceptions of Internships

When asked to rate the key elements of a successful internship, the top six responses are shown below and compared to the staff ratings for the same question.

	Students	Faculty and Staff
1.	Clear job description and expectations (75.4%)	Site supervisor (71.4%)
2.	Coordination between academics and the job-site (69.4%)	Learning objectives (61.9%)
3.	Clear instructions on workplace requirements (66.9%)	Providing feedback to students (61.9%)
4.	Prospects for future employment (66.3%)	Clarity of expectations (52.4%)
5.	Feedback for students (62.5%) Compensation (62.5%)	Coordination between the university and employer (42.9%)
6.	-	Required qualifications (42.9%)

For students, compensation ranked fifth; however, only 62% of respondents selected this response, compared to 75% of respondents selecting clear job description and expectations (the most popular answer for this question). For comparison, faculty and staff ranked compensation as the eleventh most popular key element for a successful internship. This question allowed for an "other" option; however, it ranked quite low (only 2.7% or responses).

When asked what types of internships respondents would accept, the top responses were: a paid internship that also provides academic credit (90.3%) or a paid internship alone (80.1%). Respondents ranked for credit only (38.6%) as half as popular, while an internship that is neither for credit nor paid is least popular (16.2%). Nevertheless, respondents do believe that unpaid internships provide several advantages, as shown in the table below. The table also shows that paid internships were rated higher in popularity than unpaid internships across the same categories. Respondents perceive a paid internship to provide more advantages than those that are unpaid.

Advantages of Internships

	Unpaid	Paid
Gain work experience	80.2	90.6
Skills development (e.g., communication)	70.7	84.4
Networking (e.g., developing professional contacts)	70.2	82.9
Educational development (e.g., acquiring program-related knowledge)	68.8	83.4
Explore a career field (that would otherwise not be accessible)	64.4	79.1
Personal growth (e.g., increased confidence)	61.9	80.5
Other	4.0	4.2
Financial compensation	omitted	88.4

As could be expected, the analysis of the qualitative data obtained through the open-ended answers (where only 4.2% responded) on the advantages of paid internships aligns closely to the categories listed in the question. It also highlights the point that a paid intern garners more respect for the work they do, and that it increases the number of opportunities for future employment within the organization (11% for each one).

It is important to note that despite being asked if there are advantages to unpaid internships, it is possible that respondents did not express how significant the issue of unpaid internships was in this question. Therefore, it is important that this question not be equated to students believing that unpaid internships are acceptable. There may be additional factors that might force them to accept an unpaid internship. Indeed, the qualitative responses obtained for this question in the "other" option (4% or 95 responses) highlights the following: about half (54%) expressed a strong opinion against unpaid internships. For example: "I believe that all of the advantages mentioned above are valid, but strongly believe that not being paid for work does not validate these advantages."

The rating of the disadvantages of unpaid internships highlights financial burden (86.7%) and academic burden (64.8%), with emotional hardship (51.9%) and vulnerability under the employer (50.9%) is rated lower; 8.5% said there were other concerns. While the top four themes that emerged in the analysis of the "other" responses aligned to the previously mentioned categories, they did provide richer data on the student experience and the challenges that they face (see Appendix C for the questions and responses).

The rating of the disadvantages of paid internships was quite low across the board: prioritizing performance over learning (49.2%), the employer may require interns to perform beyond academic requirements (48.4%). The temptation to withdraw from school to work was less of a concern at 33.2%; and 4.3% of responses were included the "other" concerns category. There were 102 responses in this category and most commonly, the responses indicate that there are no disadvantages in conducting a paid internship (34%).

Students have varying expenses during their studies and depending on their status, these can range from $6,513 to $36,754[6] (see Appendix A for more details). Remuneration is an important consideration for students in undertaking an internship, however, it does not seem to be the most important consideration. Indeed, while nearly half of the respondents report experiencing a great deal of financial stress, 71.6% of all respondents say they have never been unable to afford taking on an unpaid internship.

Almost 92% of respondents who have already completed a mandatory internship to fulfill their program requirements believe that their internship was effective in fostering a learning experience that was relevant to their program.

Finally, half (51%) of the respondents answered an open-ended question to suggest improvements that could be made to enhance the quality of internships overall. The five top ranked recommendations are: providing financial support for students (21.1%); allowing a wider range of students to participate in internship programs by making them more inclusive to students (for example, for students who do not meet strict GPA

[6] https://www.concordia.ca/admissions/undergraduate/costs-aid.html

requirements, have disabilities, face barriers due to language proficiency, and who are in a program that does not have an internship component) (14.2%); providing more and better support and guidance in terms of finding, obtaining and/or maintaining an internship (8.6%); increasing the number of internship opportunities that are available to students (8.3%); and increasing student awareness of the opportunities that are available (7.7%).

4.3 MEES Study

The BCI Working Group also raised the following six challenges that need to be addressed:

1. Use a typology that is easily operational and that links to the nature of internships and the objectives of university education.
2. Deconstruct myths and promote key messages to align perceptions.
3. Continue to offer supervision of internship activities and high-quality support and guidance in student training.
4. Manage institutional costs for healthy management of internships.
5. Maintain relations among all the stakeholders related to the internship.
6. Understand the impact of different models of compensation/remuneration on internships.

To address the above, the following work has already been identified or completed by the MEES[7]:

- Descriptive typology of internships included in college and university programs in collaboration with Éduconseil
- Inventory of internships in collaboration with the educational institutions
- Analysis of various aspects of internships
- Importance of internships in students' education
- Conditions to be established to guarantee good quality internships
- Support and guidance for internships and internship success
- Current measures in the areas of financial support for interns and pedagogical support and guidance for internships
- Issues raised by internships

The BCI working group defined internships in order to have a common starting point, and the following definitions were provided to guide the data collection activity.[8] The definitions used in the BCI study are:

Stage obligatoire

Ce stage fait partie intégrante du programme d'études, c'est-à-dire que l'étudiant a l'obligation de suivre le stage au cours de sa formation.

- Cette catégorie inclut le stage obligatoire sous condition d'un choix, c'est-à-dire que l'étudiant a l'obligation de choisir un stage parmi un ensemble de stages proposés et de le suivre au cours de sa formation.

[7] http://www.education.gouv.qc.ca/en/current-initiatives/student-internships/completed-work/

[8] A question was raised by the BCI about the inclusion of "stages de recherche" in the inventory, however it was argued that it opened the door for all research activity to be considered an internship and that payment for this would be unsustainable.

Objectif du stage
Pour les besoins du recensement des stages, un objectif doit être attribué à chacun d'entre eux. L'objectif du stage peut être l'observation ou, alors, l'acquisition ou la mise en œuvre de compétences.

Le stage d'observation vise, par exemple, à permettre à l'étudiant :

- de valider son choix de carrière;
- de se familiariser avec ses futures activités de travail et de saisir en quoi consistent les habiletés et les attitudes qui leur sont propres;
- de cerner les principales caractéristiques des milieux de travail où il sera appelé à exercer ses futures activités;
- d'explorer les principales tâches qu'il aura à accomplir dans l'exercice de ses futures activités.

Le stage d'acquisition ou de mise en œuvre de compétences est lié à la complexité des tâches qui sont confiées au stagiaire et à son autonomie dans la réalisation de celles-ci. Il vise, par exemple, à permettre à l'étudiant :

- de s'intégrer graduellement à un milieu de travail et d'en saisir le fonctionnement;
- de consolider ses acquis relativement aux principales tâches qu'il aura à accomplir dans l'exercice de ses futures activités de travail;
- de mettre en œuvre de façon autonome des processus de travail, c'est-à-dire d'exercer des activités de travail complexes en tenant compte de tous les facteurs en présence;
- de prendre part activement aux activités de travail du milieu;
- de mobiliser l'ensemble des connaissances, des habiletés et des attitudes acquises au cours de sa formation dans le déploiement des compétences inhérentes à ses activités de travail.

Milieu public
Ensemble des entreprises et des organismes qui relèvent de l'État. Aux fins de certaines lois, des organismes, comme les commissions scolaires et les hôpitaux, sont considérés comme faisant partie du secteur public. On les désigne souvent comme des organismes parapublics.

Milieu privé
Ensemble des entreprises qui appartiennent à des personnes physiques ou morales privées plutôt qu'à l'État ou à des collectivités publiques.

Milieu communautaire
Organisme issu de la communauté poursuivant des activités bénévoles ou des activités qui, même si elles sont rémunérées, sont sans but lucratif, et ce, dans le domaine de la santé et des services sociaux.

Rémunération et compensation financière du stagiaire
La rémunération se rapporte au salaire versé au stagiaire par l'entreprise ou l'organisme qui l'accueille en stage. La compensation financière renvoie à un montant versé au stagiaire pour le soutenir financièrement durant son stage. La compensation financière prend généralement la forme d'une bourse.

4.3.1 Overall Results

Results of the inventory gathering show that 38,000 university students hold internships in Quebec. Forty-five percent of all internships involve 200-500 hours of work; 62% of internships are in the public sector. The following summarizes the general internship statistics at Concordia in 2019.

- 34 academic departments and units offer internships
- 230 internship courses
- Internships range from 16-1680 hours
- Most internships are between 100 to 200 hours (31%) or over 1000 hours (28%)
- 32% of internships are offered through the Institute of Co-operative Education
- 52% of internships are mandatory (not including co-op, which are all optional)
- The objectives of the internship are most often to apply skills (75% popularity score)
- 88% of internships provide academic credits, most of these provide 3 credits (66%)
- 54% of internships are paid, and 11% provide some other form of financial compensation
- Payment ranges from 0$ to $30 per hour

The recommendations of this study are presented in Section 5.

5.0 RECOMMENDATIONS

The results of the studies show that while students are very satisfied with their internship experience, there is a clear need to improve the quality of the design and delivery of internships at Concordia. In this section, we provide recommendations based on the survey results and the findings from the MEES/BCI study. The recommendations are first listed, and then categorized under two broad categories, as per the MEES: 1- pedagogical support and guidance required for internships, and 2- financial assistance.

5.1 Create a standard internship agreement

Drafting a detailed internship agreement signed by all parties is crucial to setting expectations for students, faculty, supervisors, coordinators and the host organization. The Experiential Learning Office has developed internship agreement templates that are recommended for use.

As a result of the MEES study, the Ministry is producing a guide to preparing internship agreements for educational institutions to improve the student intern experience. The guide will include a definition, types and the value of internships, the roles and responsibilities of all stakeholders in the internship process, key elements to consider in an internship agreement, and important information about best practices, insurance, and sexual harassment and violence. Tools will be provided to support institutions and workplaces. More details are provided in Section 6.2. When the guide becomes available, we will adapt our templates accordingly.

Many of the following recommendations will be key to include in the Concordia internship agreement.

5.2 Scope internship appropriately

Defining the scope of the internship with the host organization and the student will ensure that the academic credits that are provided are proportional to the student's effort. In some cases, host organizations may be tempted to push the limits of the scope and students may feel obligated to meet them or else do more than is expected for personal reasons; however, a clear agreement with well-defined learning objectives should align the needs and expectations of all parties involved.

5.3 Articulate internship prerequisites and conditions

Students need to have a clear understanding of what is required in order to participate in an internship to avoid problems later. They should be clearly informed of any prerequisites such as: required qualifications including GPA, knowledge, skills, language, etc., prospects for future employment, background checks (ideally a speedier process), fee to participate, etc. Furthermore, the terms and conditions of the internship must also be clearly articulated and then later formalized in the internship agreement: hours, mandatory/optional, credit (how many)/not-for-credit, duration, hours/day and hours/week, compensation, location, liability insurance, degree of autonomy, etc.

Another point of discussion is the minimum GPA and whether it should always be a part of the internship requirements as GPA is not always an indicator of a student's performance in a practical setting. Departments should be encouraged to assess whether a GPA requirement is needed or if there should be an appropriate cut off, and

consideration could be given to other ways that students can demonstrate their readiness, for example, though a letter of intent that articulates their readiness to take on the internship and their learning goals. Doing so would ensure accessibility to a wider range of students.

5.4 Clearly define learning outcomes and reflective exercises

Learning outcomes describe the knowledge, skills and values that students will acquire by the end of the internship. Learning objectives that are specific and measurable will clearly define the scope of the internship, and provide an opportunity to give specific formative feedback to students throughout their experience. One model that can be used to define learning outcomes is SMART[9], and the Experiential Learning Office has templates that can be modified for any internship. This will help students self-assess their progress and guide supervisors through their own assessment process. In addition, reflective exercises that focus on learning outcomes provide an opportunity for students to engage in metacognitive learning practices that allow them to make more profound connections to their learning. Moreover, asking students to explain the relevance of the internship to their program of study solidifies the student's understanding of the purpose of the internship. This activity is a form of reflection that will guide the student through the experience.

5.5 Provide effective feedback

Formative feedback is crucial to the student's learning. Providing feedback that is timely and specific is crucial to students reflections on their performance and making improvements. While the host organization benefits from the student's efforts, the internship remains a formative experience in the student's career. As a result, the host organization should agree to support the student in their learning in the internship setting and have a clear understanding of how to do this appropriately through mentorship and in-kind assistance. To ensure a satisfactory standard of the quality of support, additional resources should be provided to the host organization, for example training, a guidebook, and scheduled check-ins with the internship coordinator.

5.6 Increase resources and support for students

Faculty and staff supervisors and coordinators are doing a great deal to support students before, during, and after their internships; however, there is more that they would like to do to improve the quality of support that they can provide. Increased support for the staff managing and running internship programs is essential in order to design and deliver a high quality experience for the students which includes: preparing students through CV reviews and mock interviews, following up consistently as students progress through the experience, managing business development through partnerships to increase internship offerings, and the promotion of these and other relevant opportunities. From the MEES study performed by the BCI, it was indicated that significant costs are incurred for managing and administering university internships, suggesting that the Ministry should provide funding to this end. The BCI recommends that the Ministry should provide dedicated funding to internship sites, especially those in education, health, social services, and community.

[9] Learning outcomes form, Concordia University Experiential Learning Office

5.7 Leverage internal resources to increase support

Faculty and staff reported that they do not have enough staffing or resources to identify internship opportunities. Coordinators go to great lengths to prepare students for their internships, including application and CV reviews, mock interviews, and workshops for skills development. Referring students to various units within Concordia University that provide these services could lessen the load for internship coordinators so that they can provide a more focused support in securing internships for students, in mentoring students, in developing and applying a comprehensive internship agreement with each host organization (as outlined above), and a better selection and monitoring of internship providers. Career and Planning Services, Career Management Services, and the Student Success Centre, among other units, provide a variety of preparation services and skills-based workshops for the student population. In many cases, these units provide generalized information and support to students, which is not specific to a particular field of study or professional area. It would be beneficial for these units to coordinate with the internship coordinators to develop more specialized services to meet the needs of students. The qualitative data in the student survey on suggestions for improving internships at Concordia University support this recommendation: students have asked for more support before, during, and after their internships, ranging from finding and internship, to clear communication of expectations, to mentorship, and better selection and monitoring of internship providers.

In addition, faculty and staff across different academic departments and units would benefit from communicating more regularly to share information, resources and opportunities. The Experiential Learning Office has set up a community of practice and this type of communication has proven to be very helpful and will continue to grow, and should focus on addressing topics that are of interest to all.

5.8 Evaluations of the internship experience

Gathering and providing feedback to the staff, faculty and host organizations from students on the quality of the support that they provide will make it easier to identify and address gaps in support. An institution-wide quality control assessment of internships that is based on well-defined quality assurance standards is recommended.

5.9 Increase remuneration and financial support

In most cases, it is the host organization that provides remuneration for interns. More funding is needed for students to take on internships. Where possible, funding sources should be sought in cases where the host organizations are unable to provide remuneration (for example nonprofits). Financial assistance should be sought through grants, donors, internal support, alumni, etc. as is currently being done, but support to increase efforts is recommended. The MEES has also offered some solutions to this issue. They are presented in Section 6.1.

Host organizations should also be made aware of potential sources of funding such as tax credits for hiring a student, bursaries, or other private or public incentives. In many cases, the host must apply for the funding and report to the donor at the end of the internship. Support for this process should be provided, especially to nonprofits and small businesses.

5.10 Promote awareness of health and safety support

Internship coordinators, students and host organizations need to be made aware of the supports and benefits available for students if they take on a paid or unpaid internship. Section 6.2.2 goes into detail about the protections available to students.

5.11 Develop guidebook

A guidebook for students, the university, and the host organization, would be beneficial in order to consolidate all pertinent information, resources and support in one place. Such a guidebook has already been developed in draft form. Since the MEES is also developing a guide, the Concordia guide will incorporate relevant text from that report. Currently, the guide contains information on the following:

- Sections for students, coordinators, supervisors and host organizations
- Definitions
- Learning objectives and reflections
- How to scope an internship
- Templates for students, faculty/staff, and the host organization
- Suggestions for providing effective feedback to students
- Information on student protections, including a risk chart.

5.12 Promote skills development offerings

As previously mentioned, the skills-based economy is driving opportunities for employment not only for students but for all members of society[10].

Before the internship, the skills required for the internship must be identified, and the skills that students will develop through the experience. After the internship, students should also reflect on the extent to which the skills have been developed. The focus on skills provides a more tangible way for host organizations to assess student performance and bridges the gap between academic and professional assessments. It also provides students with a straightforward language to describe their learning once they have completed their program of study.

A number of key skills are currently being captured in our programs, as survey results show. In 2018, we conducted a university-wide survey, asking faculty and staff to identify the key skills required before, during, and after and EL experience. Results show that not all of these skills are currently being acquired/offered by/to students, and therefore, in conjunction with the Student Success Centre, workshops were promoted and offered to students. These activities need to be more widely promoted and taken advantage of.

In addition to these critical 21st century 'soft' skills, an RBC study highlighted the importance of other skills as well ('hard' skills that we didn't capture in our two studies). Appendix E shows the projected list of skills demanded by all occupations from 2018-2021. It is recommended that this list be further studied and incorporated, if possible, at Concordia.

[10] The coming skills revolution: Humans Wanted, How Canadian youth can thrive in the age of disruption. The RBC Future Skills Report.

While an internship is a formative experience that provides an opportunity for students to develop those skills, only some critical future skills are developed in the curriculum. In other cases, students are not able to translate skills learned in the academic context into employment skills. More opportunities to identify, develop and translate skills within the academic curriculum would be ideal in order to ensure greater success during the internship. Academic programs should more closely align courses with the development of skills in order to (1) prepare students for their internships, and (2) to prepare students who do not have a mandatory internship to discuss their competencies post graduation. This includes describing their learning to potential employers, on graduate applications, for immersive international experiences, etc. The Vice-Provost on Innovation in Teaching and Learning is developing the Future Skills curriculum to help instructors incorporate more skills-based content within courses.

5.13 Increase internship opportunities for students

A qualitative analysis of the survey data showed that students felt that the availability of internships and the existing requirements to participate are too restrictive. They called for a more inclusive approach:

- For more academic programs to offer internships as part of the degree requirements (for credit), especially those with such a wide range of career possibilities post-graduation.
- For programs that have a co-op internship component to provide opportunities for students who do not meet the GPA requirements or who cannot complete the three summer work terms.
- For more internship opportunities for international students who carry more financial burden and who have more difficulty in finding legal work, employers who are willing to handle the additional administrative responsibility, and an English-speaking work environment.
- For additional support and consideration for students with disabilities.
- For more financial support.

5.14 Offer language courses

Since only half of the respondents were able to write and speak French fluently, we should create more opportunities to prepare students for an internship in a French-speaking environment, alternatively we should seek out more opportunities within English speaking work environments. Concordia recently launched Réussir en français, a French-language learning hub that gives students and the Concordia community at large the tools they need to succeed in French.

6.0 MEES SOLUTIONS AND RECOMMENDATIONS

In this section, we present solutions proposed by the MEES with respect to financial assistance and pedagogical support and guidance required for internships.

6.1 Financial Assistance

As a result of the MEES study, in the Plan économique de Québec presented in March 2018, the Québec Government announcement that it would invest $15 million in 2018-2019 towards required internships for students in education. Each student received $3,900 for this internship. Furthermore, the following solutions were put into place to address financial support for interns.

6.1.1 Improvement of the Loans and Bursaries Program

In accordance with the provisions of the Regulation respecting financial assistance for education expenses, an increase in the allowable expenses for students who are doing an internship is slated:

- An amount will be awarded for educational materials to students benefiting from the Loans and Bursaries Program who are doing internships. In 2018-2019, this amount varies from $191 to $471 per period of study, depending on the level of education.
- Living expenses will be adjusted to better reflect lodging costs. In 2018-2019, an amount of $281 a month is added to the assistance granted to students who must rent a second residence in order to do their internships. This amount will be increased to $486.

Under the Loans and Bursaries Program, scholarship income for the purposes of calculating the student's contribution taken into account when calculating the amount of financial assistance awarded to them comprises 100% of the amounts in excess of $5,000 received by the student as scholarships. The exemption level for scholarship income is slated to be raised from $5,000 to $7,500.

6.1.2 Bursaries to support student retention and success

A new bursary program to support interns in certain training programs in education, health and social services will be created. It will be aimed at encouraging future graduates to pursue their studies and succeed and will thus contribute to the educational success of students or the physical and mental health of the population. This bursary program will be available to just over 17,000 interns and will include the Future Teachers Appreciation Program. Programs and bursary amounts for University training:

- Bachelor's degree in education ($3 900)
- Bachelor's degree in midwifery ($4 000)
- Bachelor's degree in nursing sciences ($2 800)
- Bachelor's degree in social work or social services ($2 700)
- Master's degree in education ($3 900)
- Master's degree in remedial education ($2 500)
- Master's degree in speech therapy ($2 600)
- Master's degree in psychoeducation ($2 700)
- Master's degree in social work or social services ($2 700)

Aide financière aux études administer the program and information on the program is available on its website. More details can be found at:
http://www.education.gouv.qc.ca/fileadmin/site_web/documents/enseignement-superieur/Stages-etudiants-Portrait-enjeux-pistes.pdf

6.2 Pedagogical Support and Guidance for Internships

As a result of the MEES study, the Ministry is producing a guide to preparing internship agreements for educational institutions to improve the student intern experience. The guide will include a definition, types and the value of internships, the roles and responsibilities of all stakeholders in the internship process, key elements to consider in an internship agreement, and important information about best practices, insurance, and sexual harassment and violence. Tools will be provided to support institutions and workplaces.

6.2.1 Internship Agreement

The MEES is proposing that every internship require an agreement. The standards proposed in the guide will highlight[11]:

- the importance of signing an internship agreement between the educational institution, the workplace and the student, which should include the list of conditions that should appear in all internship agreements (number of internship hours per day and per week, terms and conditions for the termination of an internship, etc.);
- the list of items that should be included in each internship agreement;
- information about insurance for students during their internships
- best practices in pedagogical support and guidance and the drafting of clear internship objectives.

Once the report is finalized, it will be shared with relevant stakeholders at Concordia.

6.2.2 Workplace Protections

Students undertaking an internship as part of their university curriculum are covered by the university insurance, regardless of the location of the internship. The student must nevertheless respect the conditions of the host organization. If a student is invited to do an internship in one unit of a university by another educational establishment, the insurance of the host organization prevails. There may be exceptions nevertheless, and it is up to the student to inform himself/herself about the specifics of each institution with the person responsible for the internship program. This person is responsible for maintaining a good connection with the student's host organization. This person is the main facilitator among the student, academic institution, and the host organization of the student. Among this person's tasks are: defining the needs of the student in the host organization, transmitting information on the rules and procedures governing the operations of the internship process at the host organization, the evaluation of the value of internship, student counseling, the follow-up of the interns, professional development support, evaluation of the student etc.

6.2.2.1 Civil and professional responsibilities

A student is covered as follows.

- The student must be registered at a university (includes independent students or residents in medical or other disciplines).

[11] http://www.education.gouv.qc.ca/en/current-initiatives/student-internships/

- The internship must be related to the student's program of study (any student undertaking a non-credited internship outside of his/her program of study, or unrelated to the activities of his/her university is not covered).
- The internship must be supervised by a professor, an internship coordinator, or a supervisor from the host organization.
- The student must not be salaried (scholarships, packages or allowances are not considered as salaries).
- It should be noted that a student that is registered in a program regulated by a professional order should not be covered by the insurance of the professional order or by any similar protection since the student is already covered by the university.

For more information, visit: https://www.bci-qc.ca/en/students/info-stage/

Concordia's liability insurance covers student trainees, interns, and co-op students from bodily injury or property damage caused by them to a third party when they are conducting University sanctioned activities, on or off campus. However, it is not to say that the employer should not cover their own errors, omissions and/or negligence. Example: if the student caused damage to a third party while under instruction and supervision of the employer, it is not and it should not be guaranteed that the employer takes no responsibility.

6.2.2.2 Employment Rights

Québec's An Act Respecting Labour Standards defines an employee as a "person who works for an employer and who is entitled to a wage". Unpaid internships are not allowed in Québec unless the internship falls under one of the three exemptions detailed in the Act: when it is part of an academic program, if it is volunteer work done in a nonprofit organization, or as part of a vocational training program. Therefore, interns that are paid are entitled to minimum wage.

6.2.2.3 Health and Safety Rights

Paid interns are considered employees of the company and therefore benefit from CNESST protections under the Act respecting industrial accidents and occupational diseases.[12] This coverage applies to most coop students; however, for those who take on an unpaid internship, a list of students is provided to HR to have Concordia cover them under CNESST.

The "Industrial Accident Coverage During Internships" which addresses intern coverage under the Act Respecting Industrial Accidents and Occupational Diseases (ARIAOD), does not extend to all internships in which students participate (namely observation internships and unpaid internships outside Quebec when students are not Quebec residents). Therefore the BCI offers a private accident coverage program for students at participating Quebec universities subject to the applicable terms and conditions. Concordia participates in this program.

Concordia's liability insurance through *Industrielle Alliance's Accigroup insurance* covers student trainees, interns, and co-op students for accidents that cause bodily injury or

[12] Memo on Industrial accident coverage during internships from the Bureau de Coopération Interuniversitaire

property damage from a third party during a variety of University sanctioned experiential learning activities:[13]

> *As students enrolled in a program at a Quebec university, interns are covered under their institution's accident insurance. Most are therefore covered by Industrielle Alliance's Accigroup insurance. Since 2008-2009, the Ministère de l'Éducation et de l'Enseignement supérieur offers this group accident insurance plan to graduate and postgraduate students, including post-doctoral interns. At its request, this program is entirely managed by BCI, which acts as an intermediary between the universities and the insurer. A comparable insurance plan was put in place in the spring of 2008 for undergraduate students with Industrielle Alliance. The Ministère de l'Éducation et de l'Enseignement supérieur, however, does not cover the cost of this insurance. Thirteen universities participate in this optional program, through BCI.*[14]

6.2.2.4 Human Rights

In Québec, interns are entitled to protections against discrimination and harassment in employment under the Quebec Charter of Human Rights and Freedoms. Under Québec's An Act Respecting Labor Standards, the provisions concerning psychological or sexual harassment apply to student trainees (See the Act for more details).

6.2.2.5 Recommendations from MEES Study to Protect Interns

- Record all protections in the internship agreement and in guidebooks for students (all stakeholders should be aware of protections)
- Evaluate the accountability process
- Offer interns the same services and protections as those offered to students registered in the host organization
- Include the modes of protection for internships within university policies and ensure that they are enforceable.
- Proceed with the amendment to the Loi sur les normes du travail so that interns benefit from their protection.

6.2.3 Roles and Responsibilities

The MEES Guide de stage that will be available proposes a list of roles and responsibilities for the university, students, and the internship site.

University

- Select or approve the student's internship setting;
- Define learning objectives of the internship in collaboration with the host organization;
- Write up the internship agreement in collaboration with the host organization;
- Designate a coordinator who is the main facilitator between the host organization, the student and the institution and who will be in charge of the pedagogical side of the internship;
- Sign the internship agreement and respect its terms and conditions.

[13] Experiential Learning Risk Chart

[14] Note on Accigroup accident insurance coverage from the Bureau de Coopération Interuniversitaire

Host organization

- Recognize the pedagogical role that is implied by its participation in the experiential learning of the student;
- Offer internship projects where the expected tasks and responsibilities are coherent with the academic objectives of the student's program of study;
- Participate in specifying terms and conditions of the internship, particularly the definition of academic objectives of the internship with the academic institution;
- Designate a qualified internship supervisor that will serve as a resource person for the student at the host organization;
- Inform the student about the health and safety rules and the code of conduct in force at the host organization;
- Sign the internship agreement and respect its terms and conditions;
- Offer an environment that is healthy and supportive of the student's learning and development of competencies;
- Collaborate with the academic institution in case of problematic situation or conflict.

Table 3 provides a summary of our recommendations.

Table 3 Summary of recommendations

Criteria	Recommendation
Pedagogical Support and Guidance for Internships	Create a standard internship agreement.
	Scope internship appropriately.
	Articulate internship prerequisites and conditions.
	Clearly define learning outcomes and reflective exercises.
	Provide effective feedback.
	Increase internship opportunities for students.
	Conduct evaluations of the internship experience.
	Provide information and create awareness of workplace protections.
	Develop a guidebook to assist students, faculty/staff and host organization.
	Promote and increase skills development offerings.
	Increase internship opportunities for students.
	Offer language courses.
	Clarify roles and responsibilities of students, faculty/staff, and host organization.
Financial Assistance	Increase and promote awareness of remuneration and financial support (improved government assistance) and continue to look for financial assistance (grants, donors, internal support, alumni, etc.).
Faculty and Staff Support	Increase resources and support to allow for better design and delivery of internships.
	Leverage internal resources to increase support.

7.0 CONCLUSIONS

Internships are increasingly crucial to the learning experience that universities provide, and there is a growing need for and desire by students to participate in internships. The myriad of benefits for students speak volumes: strengthening the link between theory and practice, gaining professional experience and building a network, building a transferable skill set, to name a few[15]. Internships help students stay on top of labour market shifts, develop key 21st century skills, and more than ever, equip them with the experience and confidence they need to excel as they enter the precarious labour force, especially during/post-COVID-19.

Post-secondary education institutions should provide students with a quality education, a supportive learning environment, and a clear pathway to success post-graduation. Yet, the RBC Future Skills report states that "The next generation is entering the workforce at a time of profound economic, social and technological change. We know it. Canada's youth know it. And we're not doing enough about it"[16]. This mounting concern for the future of work has only been exacerbated by the worldwide COVID-19 pandemic, and so it is more important than ever to consider how we can better prepare our students for life after graduation, be it for pursuing graduate studies, entering the job market, or for participating more fully in society. A university degree often recognizes and validates what a student knows, but an experiential learning opportunity such as an internship can also demonstrate what a student can do. Of course, these two facets are not mutually exclusive, but together they make for a well-rounded educational experience that concretely demonstrates the full potential of our students. We need to invest in more of these opportunities for our students, and we need to offer them in a way that provides the most value and that has the greatest impact.

[15] *Guide d'accompagnement destiné aux établissements d'enseignement en vue de la rédaction de conventions de stage* by le Ministère de l'Éducation et de l'Enseignement Supérieur. p.6-8
[16] RBC Future Skills Report

Appendix A: Student costs chart[17]

Approximate costs for one academic year (from September to April) in Canadian dollars.

FULL-TIME (30 CREDITS)	CANADIAN CITIZENS AND PERMANENT RESIDENTS		NON-CANADIAN CITIZENS
	Quebec residents	Out-of-province residents (and citizens of France and Belgium*)	International students
Cost of study (tuition + fees). Varies by program.	$3,730 – $4,600	$8,905 – $9,775	$20,570 – $26,810
Health and dental plan (optional for Quebec and out-of-province residents, mandatory for international students)	$175	$175 ($1,176 for French and Belgian citizens)	$1,176
Other potential expenses			
Books and supplies	$2,200		
Transportation (with student discount)	$408		
On-campus housing Residence (room costs vary by floor plan) Meal plan (mandatory for students living on campus)	$3,870 – $7,320 $4,430		
Off-campus living (monthly approximation $850 rent, $100 utilities and $600 food)	$12,400		

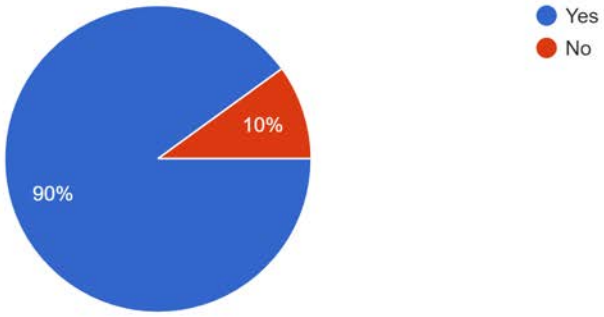
[17] https://www.concordia.ca/admissions/undergraduate/costs-aid.html

Appendix B: Faculty and Staff Survey

1. **How does your department ensure the internship placement is academically relevant to the program objectives?**

Training for students	Applications are reviewed by coordinators, faculty, etc.	Students explain relevancy, create learning outcomes etc.	Internal policies and agreements	On-site supervisors given guidance/ documentation	External regulation (government or associations)
2	5	5	2	1	2

2. **Do you provide learning objectives for the internship?**



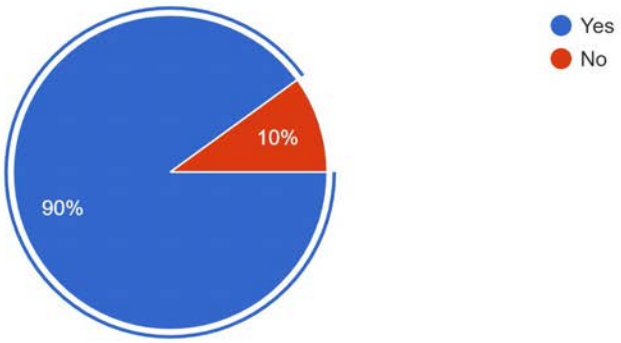
If yes, where can information on the learning objectives for the internship be found? Select all that apply.

CMS/LMS	Website	Documentation: syllabus, forms, agreements, handbook	In class
9	4	15	8

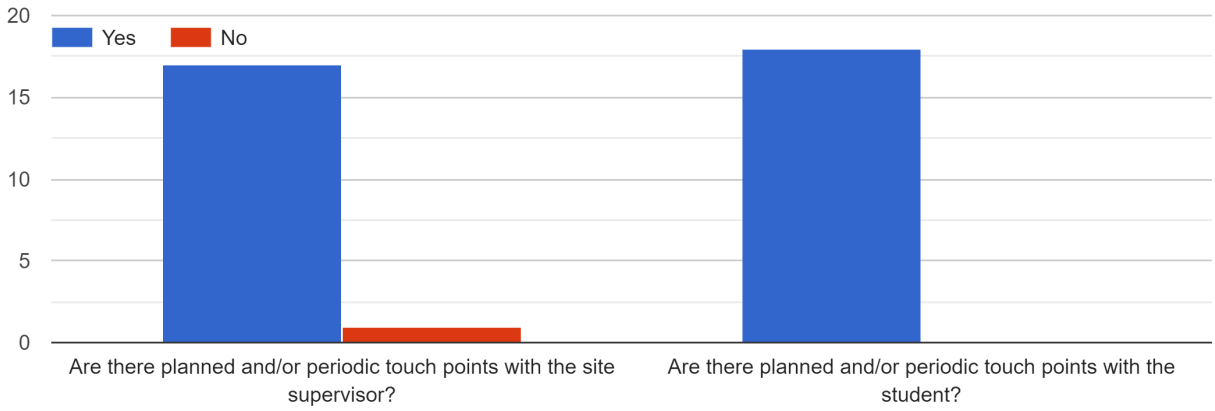
3. **How do you assess the relevance of the experience in relation to the learning objectives of the internship? Select all that apply.**

Written Report, logs, portfolios, proposals. Job description	Presentation	Supervisor Evaluation	Academic Evaluation	Site visits	Student consultations (individual/group)
19	9	17	9	1	3

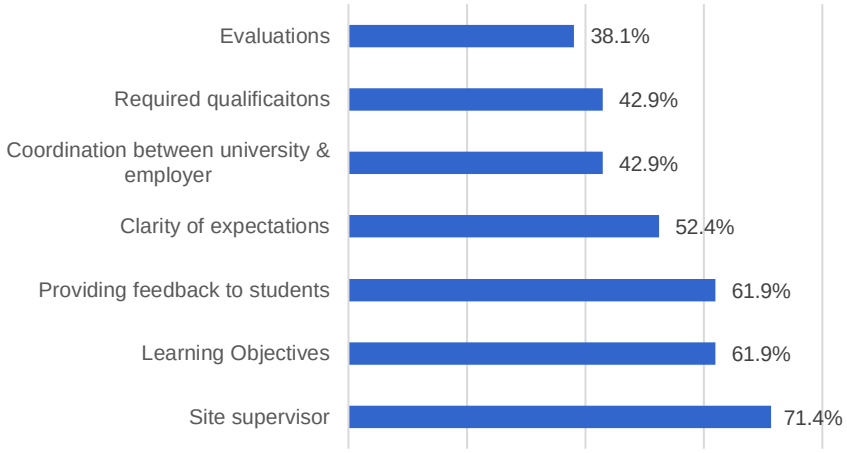
4. **Do you conduct an ongoing monitoring of the work environment where the student undertakes the internship?**



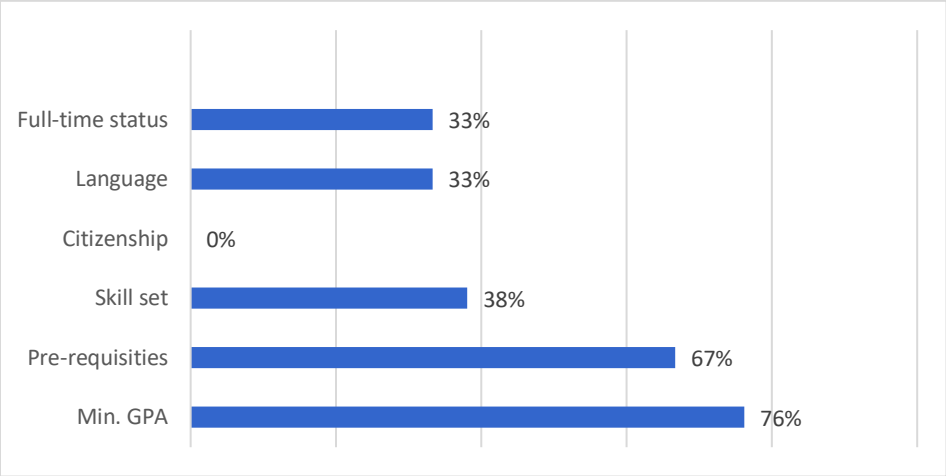
If yes:



5. **What do you consider to be key elements of a successful internship? Please select your top five.**



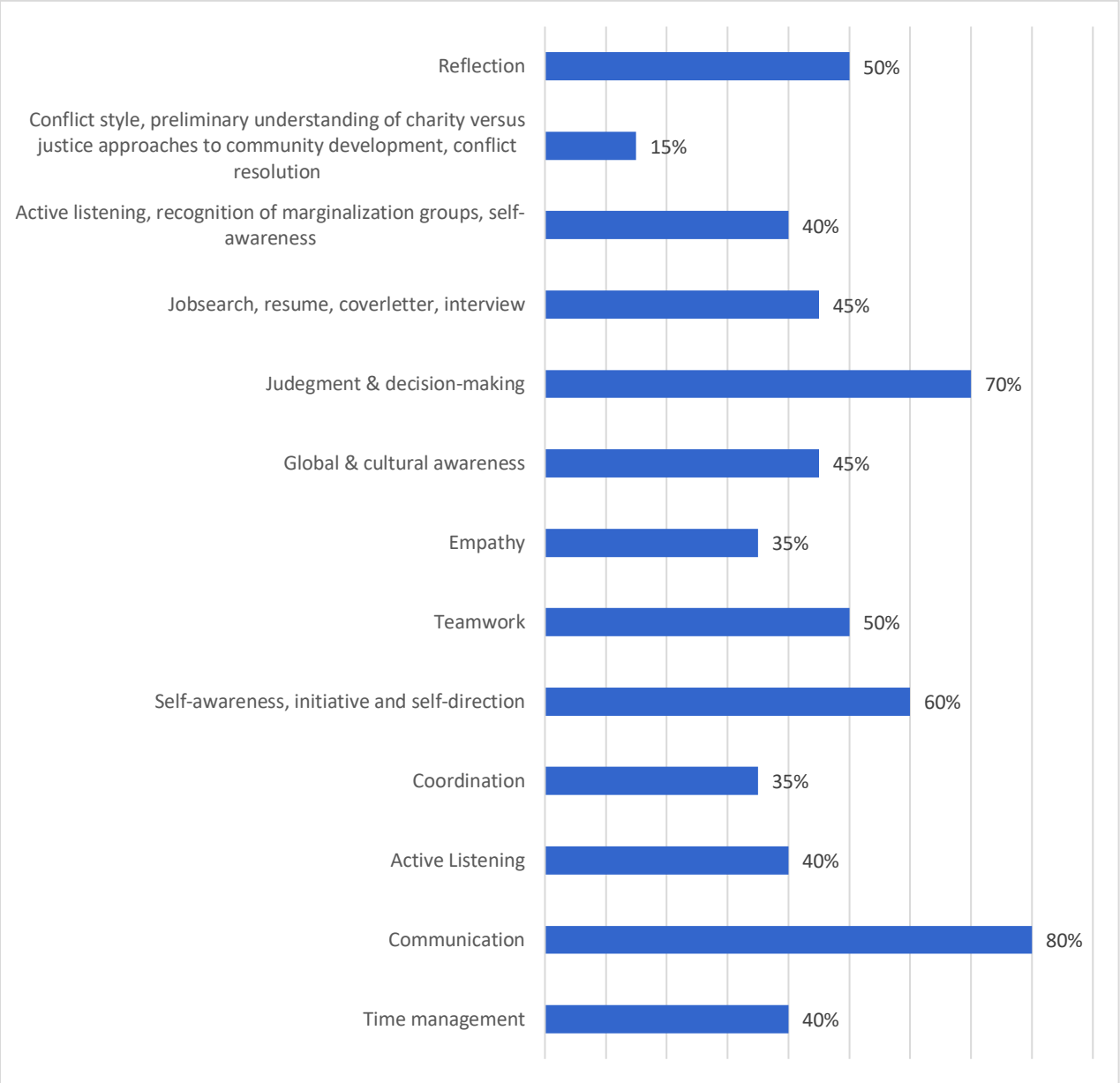
6. **Are there academic or other requirements students must have before they are able to take an internship? Select all that apply.**



If there are requirements, what are the reasons for them?

Department standards	Workplace/On the job alignment	Student skill level/preparedness	Regulatory bodies
3	5	10	2

7. Which of the following skills do students develop before the internship. Select all that apply. (Pre-EL Requirements)



8. **How much flexibility is there in your program for students who are part-time students? For example, in terms of the number of hours worked in an unpaid internship in the case of part-time students who also need to work while studying to pay for their tuition fees, living expenses, etc.**

Only full-time students	Part-time allowed
7	10

9. **How do you develop and maintain partnerships with host organizations?**

Specialized staff devoted to this	Employer database	Events	Communication with hosts	Employer demand	Student proposals for internships	Networking	Alumni
6	2	4	4	1	7	5	4

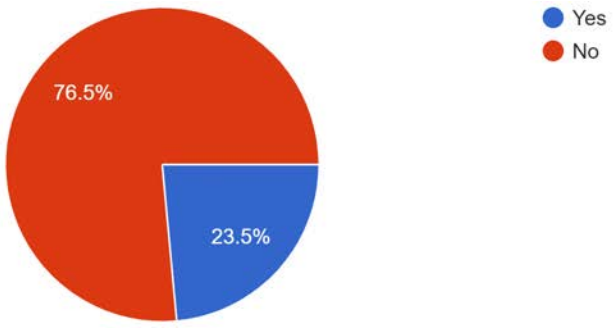
10. **If your program allows unpaid internships, what is the rationale for making it an unpaid internship?**

No UNPAID internships	Course credits	Employers do not pay: funding, union, government	Learning/ experience is the priority	Student's choice
2	3	8	3	1

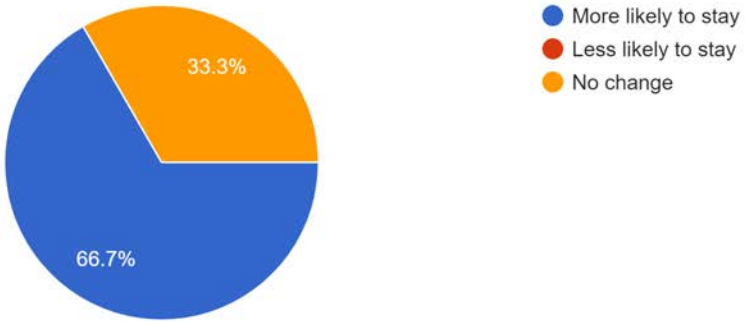
11. **If it is unpaid, what motivated your department or the organization not to provide remuneration?**

No UNPAID internships	Department doesn't have a budget to pay interns	Employers do not pay: funding, union, government	Learning/ experience is the priority	Student's choice
2	2	5	3	0

12. **Have you observed any relationship between paid/unpaid internships and retention?**



If yes, are students more likely to stay in the program, less likely or no change observed?



13. What are the existing mechanisms for dealing with conflict resolution internally (e.g. if a student contests his/her internship placement)?

Staff intervenes/ provides support to students (coordinator, faculty, director)	Student chooses their own internship; or to participate in the program	Setting expectations in advance on the scope of the internship	Communication between stakeholders	Case-by-case
11	6	1	1	1

How often has this been necessary in the last year?

None	Once	Less than 10	More than 10
11	3	2	1

14. What are the challenges to offering a paid versus unpaid internship? (Select all that apply)

Not enough sites offering paid internships	Not enough staff to find internship opportunities	Student skill set does not correspond to internship requirements	Loss of control over tasks of internship if paid	Equal access to paid opportunities for all students
13	3	1	3	1

Appendix C: Student Survey Questions

1 What is your gender identity?

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Man	986	39.1	39.1	
	Woman	1447	57.3	57.4	
	Non-binary	33	1.3	1.3	
	Another gender identity	8	0.3	0.3	
	I prefer not to respond	45	1.8	1.8	
	Total	2519	99.8	100.0	
Missing	System	5	0.2		
Total		2524	100.0		

2 Please indicate whether you consider yourself to be a member of one or more of the following employment equity groups (as defined by the Government of Canada). Select all that apply to you:

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Women	1261	50.0	50.0	
	Visible minority	532	21.1	21.1	
	Persons with disabilities	92	3.6	3.6	
	Aboriginal peoples	41	1.6	1.6	
	I prefer not to respond	143	5.7	5.7	
	N/A	710	28.1	28.1	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

3 What language(s) do you speak fluently?

		Frequency	Percent	Valid Percent	Valid Percent
Valid	English	2413	95.6	95.6	
	French	1286	51.0	51.0	
	Other	985	39.0	39.0	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

4 In what language(s) do you write?

		Frequency	Percent	Valid Percent	Valid Percent
Valid	English	2437	96.6	96.6	
	French	1241	49.2	49.2	
	Other	770	30.5	30.5	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

5 **Are you a:**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Primary caregiver	217	8.6	8.6	
	Single parent	46	1.8	1.8	
	I prefer not to respond	1042	41.3	41.3	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

6 **On average, how many hours per week do you work for pay while attending university (outside of any paid internship opportunities)?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	0 hours	829	32.8	33.1	
	1-10 hours	499	19.8	19.9	
	11-20 hours	812	32.2	32.4	
	21-30 hours	229	9.1	9.1	
	More than 30 hours	139	5.5	5.5	
	Total	2508	99.4	100.0	
Missing	No response	16	0.6		
Total		2524	100.0		

7 **Is an internship required for your academic program?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Yes	1016	40.3	40.3	
	No	1508	59.7	59.7	
	Total	2524	100.0	100.0	

Note: Question 7 has a skip rule. "NO" goes to Question 17

8 **What support, if any, does your academic program provide in finding an internship?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Supervisor/staff support (e.g., providing leads)	552	21.9	21.9	
	Networking opportunities	518	20.5	20.5	
	Skills development opportunities (e.g., interview cc	486	19.3	19.3	
	Access to a job bank	466	18.5	18.5	
	Other	116	4.6	4.6	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

Other			
Code	**Description**	**Total**	**Percentage**
List	Given list of potential internships or access to job boards	16	16%
Contact	Interactions with potential employers through interviews, meetings, fairs, cocktails, etc ...	10	10%
Guidance	Provided supervisors/coordinators/sessions to guide and inform students in their search of internships but not directly placed in internship by supervisor	3	3%
Placement	Internship is chosen and given to student by supervisor or coordinator	33	32%
Co-op	Specific program that gives students access to internship opportunities and teaches them skills to improve chances of landing internship (Combination of the codes of List, Contact, Info, Guidance and Skills)	14	14%
Skills	Taught certain skills to improve chances of landing internship	3	3%
None	Not given any support in terms of finding internship	20	19%
Unaware	Not aware of support offered	1	1%
Misc.	Answer does not correspond to question being asked or is unclear	3	3%
Total		103	100%

9 **Have you already participated in an internship while studying at Concordia?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Yes	389	15.4	38.3	
	No	627	24.8	61.7	
	Total	1016	40.3	100.0	
Missing	System	1508	59.7		
Total		2524	100.0		

Note: Question 9 has a skip rule: "NO" goes to Question 16

10 **Do you find your internship was effective in fostering relevant learning experiences for your program?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Yes	355	14.1	91.5	
	No	33	1.3	8.5	
	Total	388	15.4	100.0	
Missing	System	2136	84.6		
Total		2524	100.0		

11 **If you have taken a for-credit internship, do you think the internship course requirements were appropriate and proportionate to the number of credits received?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Yes	190	7.5	49.5	
	No	88	3.5	22.9	
	N/A	106	4.2	27.6	
	Total	384	15.2	100.0	
Missing	System	2140	84.8		
Total		2524	100.0		

12

Degree of Quality	Department	Professor	Supervisor	Site Supervisor
Poor	10.1	8.4	6.8	7.6
Fair	9.6	9.4	9.1	6.5
Average	17.4	11.5	12.5	14.4
Good	29.8	24.6	28.6	28.5
Excellent	27.7	22.3	34.9	32.4
N/A	5.4	23.8	8.1	10.7
Acceptable	57.5	46.9	63.5	60.8
Unacceptable	37.0	29.3	28.4	28.5

13

Summary of the internships already participated in by students

Typology	Valid Percent
Paid	43.5%
Unpaid	56.5%
Mandatory	89.4%
Optional	10.6%
Credit	77.1%
Not for Credit	22.9%

14

Were significant travel costs incurred as part of your internship?

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Yes	157	6.2	40.8	
	No	228	9.0	59.2	
	Total	385	15.3	100.0	
Missing	System	2139	84.7		
Total		2524	100.0		

15

Were the travel expenses covered by your program?

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Yes	18	0.7	4.7	
	No	273	10.8	70.7	
	N/A	95	3.8	24.6	
	Total	386	15.3	100.0	
Missing	System	2138	84.7		
Total		2524	100.0		

16 **What sources of financial support did or will you have to cover your expenses during your internship(s)? Select all that apply to you.**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Personal savings	560	22.2	22.2	
	Money from parents/family/spouse	537	21.3	21.3	
	Work income	527	20.9	20.9	
	Loan	276	10.9	10.9	
	Bursary	158	6.3	6.3	
	Scholarship	127	5.0	5.0	
	Line of credit	104	4.1	4.1	
	Other	23	0.9	0.9	
Total		*	*	*	
*Multiple answer percentage-count totals not meaningful				91.6	

Other

Code	Description	Total	Percentage
Aid	Provide with some amount of financial support from specific program (ex; Co-op), employer, loan	6	32%
None	No financial support provided or needed	4	21%
Pay	Use the pay from the internship or from another job	4	21%
Unsure	Have not thought about it or have not looked into it	2	11%
Misc.	Answer does not seem to respond to question	2	11%
No Int.	Will not be taking part in an internship	1	5%
Total		19	100%

17 **If you were to participate in a future internship, please indicate which type(s) of internship you would accept. Select all that apply to you.**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	For credit - paid	2278	90.3	90.3	
	Not for credit - paid	2022	80.1	80.1	
	For credit - unpaid	975	38.6	38.6	
	Not for credit - unpaid	409	16.2	16.2	
Total		*	*	*	
*Multiple answer percentage-count totals not meaningful					

	For credit	Not for credit
Paid	30.80%	78.20%
Unpaid	67.10%	15.60%
No response	2.20%	6.20%
Mandatory	94.50%	61.50%
Optional	2.50%	30.20%
No response	3%	8.40%

18 **What do you consider to be the advantages, if any, of unpaid internships?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Gain work experience	2025	80.2	80.2	
	Skills development (e.g., communication)	1785	70.7	70.7	
	Networking (e.g., developing professional contacts	1773	70.2	70.2	
	Educational development (e.g., acquiring program	1737	68.8	68.8	
	Explore a career field (that would otherwise not be	1625	64.4	64.4	
	Personal growth (e.g., increased confidence)	1563	61.9	61.9	
	Other	101	4.0	4.0	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

Other

Code	Description	Total	Percentage
Experience	Gain valuable experience in the field that can be applied in future endevours or realize new personal experiences	12	12%
Employment	Potential employment with company at end of internship or once graduated / Easier time finding employment in the field in the future	6	6%
Learn	Learn skills and gain knowledge of field/company for which internship is associated with	6	6%
Credit	Receive academic credit(s) that allows student to graduate	4	4%
Apply	Provides opportunity to apply theories and knowledge learned from courses in real life work environment	2	2%
Free	Free labour for employers	2	2%
None	No advantages of unpaid internships	18	19%
Same	Same or similar advantages as a paid internship minus the compensation	6	6%
All	All of the advantages presented in the question	6	6%
Reference	Provides a useful reference for resumes, letters and networking events	2	2%
General	Participant indicated there are advantages but did not specify	2	2%
Options	More options for internships and freedom to select one based on preference	2	2%
Mental	Increased emotional state (self-confidence, sense of worth, less stress) and/or improved mental health	6	6%
Misc.	Answer does not correspond to question being asked or is unclear	23	24%
Total		97	100%
Agree	In favour of unpaid internships to varying levels	5	5%
Disagree	Against unpaid internship to varying levels	51	54%
No Opinion	Neither for nor against unpaid internships	39	41%
Total		95	100%

19 What do you consider to be the disadvantages, if any, of unpaid internships?

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Financial burden	2188	86.7	86.7	
	Academic burden (affects ability to focus on schoo	1636	64.8	64.8	
	Emotional and/or mental hardship	1311	51.9	51.9	
	Vulnerability with respect to employer (e.g., assign	1284	50.9	50.9	
	Other	215	8.5	8.5	
Total		*	*	*	

*Multiple answer percentage-count totals not meaningful

Coding Legend

Code	Description	Total	Percentage
Financial	Do not receive financial compensation from internship / Incure financial issues due to no compensation / Need to work another job to avoid financial issues	64	27%
Respect	Intern not given adqueate respect as a worker (given mininal and/or meanial tasks, not taken seriously, wasting their time, ect.) and/or as a person (overworked, taken advantage of, exploited, ect.)	53	22%
Health	Lowering of emotional state of any kind (ex: reduced confidence/self esteem, increased stress, dimishing mental health) or dimished physical health (lack of coverage for injuries)	25	10%
Motivation	Lack of motivation to perform work	8	3%
Demanding	Takes up too much time / Leaves minimal or no amount of time left to properly work/study/take care of one's self/family / Requires intern to potentially work, study and conduct internship all at once	44	18%
Industry	Negatively effects other workers of the industry/company either by replacing/taking their jobs or reducing their wage/work conditions	6	3%
All	All of the disadvantages presented in the question	5	2%
None	No disadvantages	1	0%
Elitist	Prepetuates certain socital phenomenons such as elitsm and class disparity by only being accessible to those who are finacially well off	7	3%
Unethical	Morally wrong, unfair, and unjust by allowing the act of unpaid labour to continue	11	5%
Misc.	Answer does not correspond to question being asked or is unclear	13	5%
Enviornment	Physical working space is subpar or working atmosphere is hostile/not welcoming	3	1%
Total		240	100%

20 What do you consider to be the advantages, if any, of paid internships?

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Gain work experience	2287	90.6	90.6	
	Financial compensation	2230	88.4	88.4	
	Skills development (e.g., communication)	2130	84.4	84.4	
	Educational development (e.g. acquiring program-	2105	83.4	83.4	
	Networking (e.g., developing professional contacts	2092	82.9	82.9	
	Personal growth (e.g., increased confidence)	2032	80.5	80.5	
	Explore a career field (that would otherwise not be	1996	79.1	79.1	
	Other	106	4.2	4.2	
Total		*	*	*	

*Multiple answer percentage-count totals not meaningful

Coding Legend			
Code	**Description**	**Total**	**Percentage**
Respect	Intern is given more respect and value as a worker and a person	13	11%
Employement	Potential employment with company at end of internship or once graduated / Easier time finding employment in the field in the future	13	11%
Mental	Increased emotional state (self-confidence, sense of worth, less stress) and/or improved mental health	22	18%
Experience	Gain valuable experience in the field that can be applied in future endevours or realize new personal experiences	12	10%
Income	Earn extra income that can be used in various ways (savings, financial support, student loans) and/or the benefits that provides (less financial burden, no need for second job, ect.)	25	21%
All	All of the advantages presented in the question	3	3%
Influence	Can help the intern determine if this is the correct field for them or what field they would like to pursue a career in	7	6%
Motivation	Intern is more motivated to working hard or finds new motivation to continue their efforts in their academic careers	7	6%
Protected	Intern is protected by government laws and rules assocaited with workers, and have more rights as a result	2	2%
Reference	Provides a useful reference for resumes, letters and networking events	1	1%
Study	More time to focus on studying	4	3%
General	No specific advantages listed but are in favour of paid internships and indicate that they are beneficial	3	3%
Schedule	A proper and consistent working schedule	2	2%
Misc.	Answer does not correspond to question being asked or is unclear	5	4%
Total		119	100%

21 **What do you consider to be the disadvantages, if any, of paid internships?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Focus placed on performance in work rather than l	1242	49.2	49.2	
	Employer may require intern to do more than what	1222	48.4	48.4	
	Temptation to withdraw from school to work	837	33.2	33.2	
	Other	109	4.3	4.3	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

Coding Legend			
Code	**Description**	**Total**	**Percentage**
None	No disadvantages of an paid internship	38	34%
Mental	Lowering of emotional state of any kind (ex: reduced confidence/self esteem, increased stress, dimishing mental health)	11	10%
Respect	Intern not given adqueate respect as a worker (given mininal and/or meanial tasks, not taken seriously, wasting their time, ect.) and/or as a person (overworked, taken advantage of, ect.)	12	11%
Financial	Intern receives low compensation for work and/or is not paid what they were orgininally promised by employer / Intern has to pay more federal/provincial taxes due to the extra income	8	7%
Academics	Negatively affects intern's academic performance/commitment and/or intern struggles to balance work and studies	17	15%
Pay Only	Intern only takes the opportunity due to the compensation and not due to it being in their desired field and/or it providing beneficial experience	4	4%
All	All of the disadvantages presented in the question	2	2%
Misc.	Answer does not correspond to question being asked or is unclear	9	8%
Demanding	Very time demanding and/or leaves little time for self/social life/other job	5	5%
Unrelated	Internship is not related to the intern's field of study or does not fit their skills	4	4%
Competitive	Paid internships are very competitive with high amounts of students applying for a limited amount of positions	1	1%
Total		111	100%

22 **What would you consider to be the key elements of a successful internship? Please select all that**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Clear job description and expectations	1903	75.4	75.4	
	Coordination between academics/job-site	1752	69.4	69.4	
	Clear instructions on workplace requirements (e.g	1689	66.9	66.9	
	Prospects for future employment	1673	66.3	66.3	
	Feedback mechanism for students	1577	62.5	62.5	
	Compensation	1576	62.4	62.4	
	Task clarity	1507	59.7	59.7	
	Duration (appropriate length of time)	1458	57.8	57.8	
	Defined learning objectives	1364	54.0	54.0	
	Active supervision by the on-site supervisor	1337	53.0	53.0	
	Clear articulation of internship expectations	1303	51.6	51.6	
	Credits	1299	51.5	51.5	
	Evaluation	1217	48.2	48.2	
	Convenient location	1200	47.5	47.5	
	Resource support	1117	44.3	44.3	
	Having the required qualifications to perform interr	1050	41.6	41.6	
	Autonomy	1013	40.1	40.1	
	Relationship to program: mandatory/nonmandator	917	36.3	36.3	
	Staff coordination	873	34.6	34.6	
	Conflict resolution process/procedures	830	32.9	32.9	
	Active supervision by the faculty supervisor	821	32.5	32.5	
	Inclusive practices (accommodations)	778	30.8	30.8	
	Liability insurance	742	29.4	29.4	
	Standardization of paperwork	661	26.2	26.2	
	Other	68	2.7	2.7	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

Coding Legend			
Code	**Description**	**Total**	**Percentage**
Guidance	Intern receives adequate guidance and mentorship from employer(s) and/or supervisor(s)	13	16%
Respect	Intern is given adequate respect and value as a worker and a person	10	13%
Relevant	Intern gains experience and performs tasks that are relevant to their field of study and/or their passion instead of performing meanial tasks or doing nothing at all	10	13%
Compensation	Intern is rewarded for their work either through financial compensation or through academic credits	10	13%
Environment	Intern is presented with a positive work environment	13	16%
All	All of the elements presented in the question	1	1%
Employment	Potential employment with company at end of internship or once graduated	1	1%
Autonomy	Intern is given adequate autonomy and independence while working	3	4%
Learn	Internship provides the intern with proper training and the opportuinity to expand knowledge/skills rather than just perform tasks	13	16%
Academics	Internship does not interfere or have a negative effect on the intern's academic performance or avalibility	3	4%
Accomodating	Internships is accomodating to the intern's personal/family/work situation	3	4%
Total		80	100%

23 **What are your financial responsibilities while you are attending university?**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Transportation	1997	79.1	79.1	
	Course materials	1885	74.7	74.7	
	Tuition	1881	74.5	74.5	
	Living expenses	1652	65.5	65.5	
	Medical expenses	1128	44.7	44.7	
	Childcare	120	4.8	4.8	
	Other	119	4.7	4.7	
Missing	System	643	25.5	25.5	
Total		*	*	*	

**Multiple answer percentage-count totals not meaningful*

Coding Legend			
Code	**Description**	**Total**	**Percentage**
Leisure	Payments, expenses and purchases associated with leisure activities, products or services	32	24%
Car	Payements, expenses and purchases associated with an automobile or vehicule	7	5%
Communication	Payments, expenses and purchases associated with phone or internet usage	11	8%
Food	Purchases associated with non-leisure food and beverages (i.e groceries)	15	11%
Family	Payements, expenses and purchases associated with the care of children/family/loved ones	21	16%
Health	Payements, expenses and purchases associated with personal physical and mental health	7	5%
Home	Payments, expenses and purchases associated with lodging	4	3%
Financial	Payments and expenses associated with personal loans and/or debts	13	10%
Productivity	Payments, expenses and purchases associated with school and/or work	6	5%
Abroad	Payments, expenses and purchases associated with going to university abroad/not in home town	6	5%
All	All of the responsibilities mentioned in the question	3	2%
None	Do not have to persoanlly pay for anything	8	6%
Total		133	100%

24 **Please indicate to what extent you experience financial stress while attending university.**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	None	170	6.7	6.9	
	Little	362	14.3	14.6	
	Some	775	30.7	31.4	
	Much	587	23.3	23.7	
	A great deal	578	22.9	23.4	
	Total	2472	97.9	100.0	
Missing	System	52	2.1		
Total		2524	100.0		

25 **Have you ever been unable to participate in an unpaid internship because you could not afford to**

		Frequency	Percent	Valid Percent	Valid Percent
Valid	Yes	620	24.6	25.5	
	No	1808	71.6	74.5	
	Total	2428	96.2	100.0	
Missing	System	96	3.8		
Total		2524	100.0		

26 How do you suggest we improve the quality of internships at Concordia University?

Coding Legend

Code	Description	Total	Percentage
Increase	Increase the total number of internships offered by Concordia University and/or made available to Concordia's students	167	8.3%
Quality	Provide internships that are of sufficient quality in terms of work being asked of intern, respect given towards intern, working enviorment of the internship, amount of learning, ect...	104	5.2%
Financial	Ensure all/most internships are paid and/or provide/allow financial support to students	424	21.1%
Credit	Have internships that reward the student with academic credits or alter the amount of credits currently offered	59	2.9%
Awareness	Increase students' awareness of the internships offered and/or the other efforts that Concordia is currently offering or should offer in regards to internships	155	7.7%
Accommodating	Be more accepting and accomodating to a number of factors by offering a wider variety of internships and/or making them more inclusive (i.e. lower gpa, disabilities, language, field of study, residence location, work location preferences, ect...)	285	14.2%
Contact	Ensure that the Concordia has better connections with more and/or higher quality buisness and/or provide students with more access to these potential employers	105	5.2%
Co-op	Improve and/or alter the Co-op Institution	114	5.7%
Skills	Increase efforts to teach students practical skills that are necessary to obtain and/or succeed in an internship	31	1.5%
Support	Provide students with more/better support and guidance in terms of finding, obtaining and/or maintaing an internship	173	8.6%
Deadline	Make deadlines for internship applications and internship-related work more flexible and realistic	15	0.7%
Graduate	All or some of the sugeestions are related to graduate students specifically	42	2.1%
Abroad	All or some of the sugeestions are related to international students specifically	37	1.8%
Simplify	Simplify and/or streamline the process of finding, applying and obtaining an internship	76	3.8%
Mandatory	Make internships mandatory for all/some programs	42	2.1%
Optional	Do not make internships mandatory for all/some programs	16	0.8%
Clarity	Ensure that supervisors employers are providing the intern with clear, obtainable goals and objectives for the internship and/or its related work / Concordia is providing clear instructions on how to find, obtain and maintain an internship	50	2.5%
Feedback	Ensure that supervisors, employers and/or students are all able to provide feedback and are able to communicate about the internship and/or eachother	34	1.7%
None	Simplify and/or streamline the process of finding, applying and obtaining an internship	49	2.4%
General	Indicate improvements are necessary but do not specify an suggestions	4	0.2%
Reduce	Reduce the amount of work and hours associated with internships	22	1.1%
Misc.	Answer does not correspond to question being asked or is unclear	7	0.3%
Total		2011	100%
	Total Number of Responses:	1275	

Appendix D: Concordia BCI Study Questions

Number of credits	
	Percentage
0	12%
3	66%
6	8%
9	3%
12	1%
15	1%
18	0.4%
21	0.4%
Blank	8%

Mandatory Internships	
	Percentage
Yes	52%
No	48%

Internship Objectives	
	Percentage
Acquiring Skills	25%
Applying Skills	75%
Observation	0.4%

Number of hours	
	Percentage
100 or less	12%
101 to 200	31%
201 to 280	7%
301-400	2%
401-500	15%
501-600	3%
601-800	3%
1000+	28%

Full or Part Time		
	Frequency	Percentage
Full Time	15	7%
Part Time	70	30%
No answer	145	63%

Coop Internships		
	Frequency	Percentage
Yes	75	33%
No	155	67%

Sector		
	Frequency	Percentage
Private	123	53%
Public	62	27%
Community	37	16%
No answer	8	3%

Compensation for Internship		
Remuneration	124	54%
Financial Compensation	25	11%
No Financial compensation	73	32%
No answer	8	3%

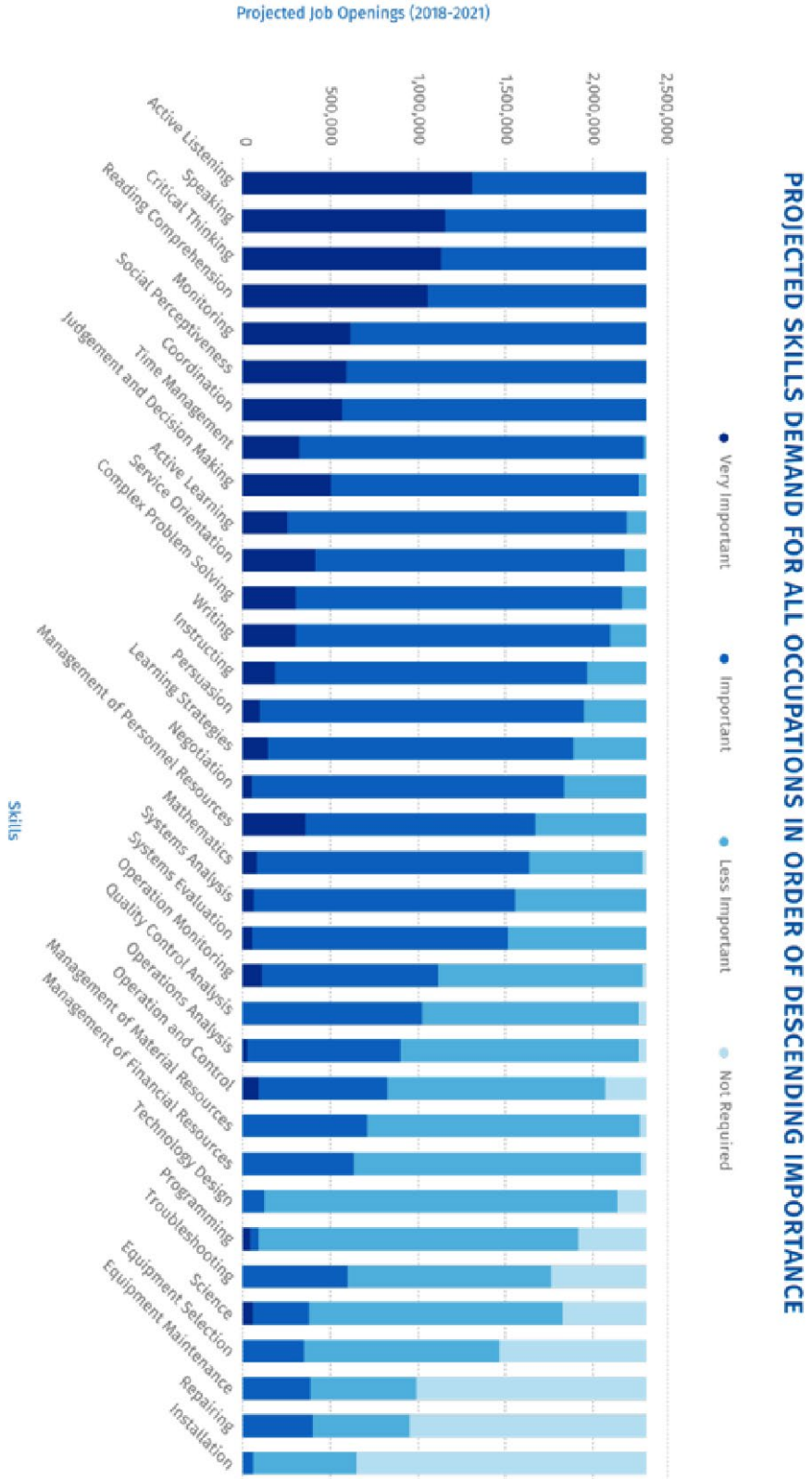
The following three questions were added to the Concordia BCI study inventory.

Application/Selection Process	
Yes	66%
No	17%
No Answer	16%

Support Provided to Students	
Type of support	Popularity of response
Job Bank	4%
Remuneration	2%
Checkins, consultations & supervision	52%
Mentoring or counselling	7%
An evaluation	7%
Site visits	11%
Course, class & seminar	16%

Is language a barrier to securing internships?			
Yes	No	Sometimes	No response
25%	48%	4%	19%

Appendix E: RBC Future Skills Report



What We Found

Learnings from our cross-country research project

1. More than 25% of Canadian jobs will be heavily disrupted by technology in the coming decade. Fully half will go through a significant overhaul of the skills required.

2. An assessment of 20,000 skills rankings across 300 occupations and 2.4 million expected job openings shows an increasing demand for foundational skills such as critical thinking, co-ordination, social perceptiveness, active listening and complex problem solving.

3. Despite projected heavy job displacement in many sectors and occupations, the Canadian economy is expected to add 2.4 million jobs over the next four years, all of which will require this new mix of skills.

4. Canada's education system, training programs and labour market initiatives are inadequately designed to help Canadian youth navigate this new skills economy.

5. Canadian employers are generally not prepared, through hiring, training or retraining, to recruit and develop the skills needed to make their organizations more competitive in a digital economy.

6. Our researchers identified a new way of grouping jobs into six "clusters," based on essential skills by occupation rather than by industry.

7. By focusing on the foundational skills required within each of these clusters, a high degree of mobility is possible between jobs.

8. Digital fluency will be essential to all new jobs. This does not mean we need a nation of coders, but a nation that is digitally literate.

9. Global competencies like cultural awareness, language, and adaptability will be in demand.

10. Virtually all job openings will place significant importance on judgment and decision making and more than two thirds will value an ability to manage people and resources.