Minutes of the Seventh Meeting of Senate
Friday, April 1, 2016
3:00 – 5:00 pm
Room 242, McDougall Hall

Present: A. Abd-El-Aziz (Chair), B. Awosile, R. Bissessur, A. Braithwaite, B. Campbell, A. Carrothers, L. Chilton, G. Conboy, T. Doucette, M. Doyle, L. Edwards, N. Etkin, P. Foley, R. Gilmour, K. Gottschall-Pass, S. Graham, G. Irvine, Z. Jarvis, G. Keefe, K. Kielly, D. Kenny, N. Kujundzic, G. Lindsay, C. Lacroix, J. MacDonald, R. MacDonald, D. MacLellan, D. Moses, M. Murray, S. Myers, J. Podger, J. Preston, J. Rix, N. Saad, J. Sentance, O. Shaw**,** S. St. Hilaire, K. Teather and S. Wilfeard

Regrets: J. Krause, S. McConkey, C. Parker and C. Ryan

Recorder: D. MacLean, Administrative Assistant to Senate

President Alaa Abd-El-Aziz called the meeting to order at 3:05 p.m.

1. Approval of Agenda
MOTION (L. Edwards/J. Preston) to approve the agenda as presented. CARRIED

2. Approval of Minutes – February 26, 2016
MOTION (D. MacLellan/L. Chilton) to approve the minutes of February 26, 2016 as presented. CARRIED

3. Business Arising
There was no business arising from the minutes.

4. President's Report
President Abd-El-Aziz welcomed Donald Moses and Scott Lee to their first Senate meeting. Also, he noted that next Tuesday, April 5th will be the last day of classes for this semester and wished students, Faculty and staff all the best in preparation for exams.

The President informed Senators of a number of administrative changes that will take place in the next few days. In anticipation of another difficult budget scenario, and recognizing previous budget decisions to maintain sustainability involved the laying off of staff and sessionals, today's decisions reflect changes in senior administration and managerial positions. The position of Vice President Academic is being amalgamated with the position of Vice-President Research and Graduate Studies, and the new title will be Vice President Academic and Research. All functions of the previous two Vice President positions will now be fulfilled by the Vice President Academic and Research. Dr. Robert Gilmour will fulfill this role until June 30, 2017 while a search is being conducted. Dr. Christian Lacroix has agreed to be an adviser on academic matters to the President for the next six months. A reduction of six managers under the Office of Vice President Administration and Finance will also take place in the near future. Information of these changes will be released to the campus community later today. The President thanked the senior team for making these very difficult decisions which were months in the making. Also, the President indicated that he discussed these changes with the Steering Committee of Senate, the Executive Committee of the Board, Union leaders, the Student Union President and Deans prior to

this meeting. These changes will ensure more resources are available for our operations. The question of cost savings was raised as well as one person carrying the load of VP Academic and VP Research. The President thanked Dr. Lacroix for his years of service as Vice President and his continuous support for the University.

5. Senate Reports

a. Senate Steering and Nominating Committee Report

K. Gottschall-Pass presented the Senate Steering and Nominating Committee Report for information and details are noted below:

1) Christina Murray, School of Nursing, was nominated as the Nursing representative to sit on Senate from July 1, 2016 to June 30, 2019. Since there were no nominations from the floor at the recent General Faculty meeting, she has been acclaimed.

2) Jane Preston, Faculty of Education, was nominated as the Education representative (second term) to sit on Senate from July 1, 2016 to June 30, 2019. Since there were no nominations from the floor at the recent General Faculty meeting, she has been acclaimed.

3) Dr. Ann Braithwaite, DSJS, Faculty of Arts, was one of two faculty nominated as the Arts representative to sit on Senate from July 1, 2016 to June 30, 2019. An electronic vote was recently carried out, and Dr. Braithwaite was voted in.

4) Dr. Scott Lee, Modern Languages, has agreed to replace Dr. Benet Davetian on Senate for the remainder of his term, to June 30, 2018.

5) Dr. Tarek Mady, School of Business, has agreed to sit on Senate as a School of Business representatative from July 1, 2016 to June 30, 2019

b. Senate Academic Planning and Curriculum Committee Report

i. Seventh Curriculum Report

FACULTY OF ARTS

University 100

1) Motion (C. Lacroix/N. Kujundzic) that University 151, Digital Literacy for workforce Learning and Success in the 21st Century, be approved.

University 151, Digital Literacy for Workforce Learning and Success in the 21st Century

The goal of this course is to teach and assess digital concepts and skills that over 80% of employers look for in potential employees. The course will scaffold learning in a three themes module format as: *(1) Digital Citizenship in Learning and the Workplace; (2) Information and Communication in the 21st Century; and (3) Applying Digital Literacy in the 21st Century Workplace.* As students gain experience with various digital tools, students will be asked to apply these tools in a project-based setting to investigate real-world issues and create meaningful and relevant products. Students will experience the course in a hybrid model of face-to-face and online formats; along with elements of a flipped classroom where students review learning before class so that class time can be spent on critical dialogue and meaningful discussion and project work.

Cross Listing: None

Prerequsite/Co-Requisite: None

Semester Credit Hours: Three semester hours
CARRIED

SCHOOL OF BUSINESS

2) Motion (C. Lacroix/A. Carrothers) to approve the change of ACCT 412 from a fourth year course to a third year course, to update the course description, and to approve the change of the prerequisite requirements.

Bachelor of Business Administration
Revised
~~412~~ 312 COST ACCOUNTING
Topics include standard costing, budgets, flexible budgets, variance analysis, pricing, relevance and decentralization, and transfer pricing. This course will also incorporate case studies to highlight the application of methodology.
PREREQUISITE: A minimum of 60% in Accounting 221 and a minimum of third year standing in an undergraduate program ~~and a minimum grade of 60% in Acct 302~~ or permission of the instructor.
CARRIED

FACULTY OF SCIENCE
Applied Health Sciences

3) Motion (C. Lacroix/D. MacLellan) that the course name and course description for KINE 443 be revised to remove exercise prescription and assessment and include physiological adaptations to chronic exercise.

Revised
443 ADVANCED PHYSIOLOG~~ICAL ASSESSMENT AND TRAINING~~ Y OF EXERCISE ADAPTION AND PERFORMANCE
This course combines theoretical background with applied learning experiences in advanced fitness appraisal methods and techniques~~, physical activity/exercise prescription, and lifestyle assessment~~. Attention will be given to ~~exercise management and counselling across a variety of populations as well as the role and effects of pharmaceuticals.~~ the biochemical, molecular, and metabolic perturbations associated with acute exercise and how these effects translate into chronic exercise adaptations, athletic performance, and health. ~~Students will complete assessments of their own health or performance related fitness and implement a personalized program to track their progress toward a goal.~~ Students will take part in maximal fitness testing procedures within the laboratory setting.
PREREQUISITE: Kinesiology 343
Three lecture hours, three hours laboratory
CARRIED

Mathematical and Computational Sciences

OMNIBUS Motion (C. Lacroix/D. MacLellan) that motions 4-88 as noted below be approved:

4) That the following course be approved as presented:

AMS 216 Mathematics of Finance
This first course in the mathematics of finance includes topics such as measurement of interest; annuities and perpetuities; amortization and sinking funds; rates of return; bonds and related

securities; life insurance.
Prerequisite/Co-Requisite: Math 191
Semester Credit Hours: 3
CARRIED

5) That the following course be approved as presented:

AMS 240 Financial Mathematics & Investments
Advanced topics of Theory of Interest as initially covered in AMS 216 including time value of money, annuities, loans, bonds, general cash flows, portfolios and immunization concepts as well as an introduction to capital markets, analysis of equity and fixed income investments, and an introduction to derivative securities including futures, forwards, swaps and options.
Prerequsite/Co-Requisite: AMS 216
Semester Credit Hours: 3
CARRIED

6) That the following course be approved as presented:

AMS 241 Financial Economics I
Introduction to mathematical techniques used to price and hedge derivative securities in modern finance. Modelling, analysis and computations for financial derivative products, including exotic options and swaps in all asset classes. Applications of derivatives in practice will also be discussed.
Prerequsite/Co-Requisite: AMS 240
Semester Credit Hours: 3
CARRIED

7) That the following course be approved as presented:

AMS 251 Actuarial Science I
This course will explore the future lifetime random variable, probability and survival functions, force of mortality; complete and curtate expectation of life, and Makeham and Gompertz mortality laws. Other topics will include: Life tables, characteristics of population and insurance life tables, selection, and fractional age assumptions. Life insurance payments and annuity payments: Present value random variables; expected present values; higher moments; actuarial notation, annual, 1/mthly and continuous cases, relationships between insurance and annuity functions. Premiums, expense loadings, present value of future loss random variables and distribution, net and gross cases, the equivalence principle and portfolio percentile principle will also be discussed.
Prerequsite/Co-Requisite: AMS 240 and STAT 321
Semester Credit Hours: 3
CARRIED

8) That a new course, AMS 286 Actuarial Mathematics Lab I be approved as presented.

AMS 286 Actuarial Mathematics Lab I
This lab features problem-solving session for the professional examination on financial mathematics of the Society of Actuaries and the Casualty Actuarial Society.
Prerequsite/Co-Requisite: AMS 216
Semester Credit Hours: 1

CARRIED

9) That a new course, AMS 294 Optimization, be approved as presented.

AMS 294 Optimization
An introduction to the methods and applications of linear programming. Topics include linear programming formulations, the simplex method, duality and sensitivity analysis, and integer programming basics. Applications to transportation, resource allocation and scheduling problems will be examined. Software will be used to illustrate topics and applications.
Prerequsite/Co-Requisite: Math 261
Semester Credit Hours: 3
CARRIED

10) That a new course, AMS 316 Game Theory, be approved as presented.

AMS 316 Game Theory
The course covers the fundamentals of game theory and its applications to the modeling of competition and cooperation in business, economics, biology and society. It will include two-person games in strategic form and Nash equilibria, extensive form games, including multi-stage games, coalition games and the core Bayesian games, mechanism design and auctions.
Prerequsite/Co-Requisite: Math 192, Math 242 and Stat 222
Semester Credit Hours: 3
CARRIED

11) That a new course, AMS 331 Advanced Corporate Finance for Actuaries, be approved as presented.

AMS 331 Advanced Corporate Finance For Actuaries
This course covers various advanced topics in corporate finance, with emphasis on theories of corporate incentives and asymmetric information. Illustrative applications using cases are provided. Topics include: capital budgeting, real options, investment decision using Markowitz and utility theory, the Capital Asset Pricing Model, Arbitrage Pricing Theory, market efficiency and capital structure and dividend policy. Other topics may include time value of money, capital budgeting, cost of capital, security issuance, capital structure, payout policy and dividends, short-term finance, and risk management. Where suitable, topics are treated from a mathematical and quantitative perspective.
Prerequsite/Co-Requisite: AMS 240 and BUS 231
Semester Credit Hours: 3
CARRIED

12) That a new course, AMS 341 Financial Economics II, be approved as presented.

AMS 341 Financial Economics II
This course will discuss advanced mathematical techniques used to price and hedge derivative securities in modern finance. Topics include: modelling, analysis and computations for financial derivative products, including exotic options and swaps in all asset classes. Students will also have the opportunity to apply these derivatives in practice.
Prerequsite/Co-Requisite: AMS 241
Semester Credit Hours: 3

CARRIED

13) That a new course, AMS 351 Actuarial Science II, be approved as presented.

AMS 351 Actuarial Science II
This course will discuss: policy values, annual, 1/mthly and continuous cases, Thiele's equation, policy alterations, modified policies and multiple state models. Other topics will include applications in life contingencies, assumptions, Kolmogorov equations, premiums, policy values, multiple decrement models, Joint Life Models, Valuation of insurance benefits on joint lives, and dependent and independent cases.
Prerequsite/Co-Requisite: AMS 251 and Stat 322
Semester Credit Hours: 3
CARRIED

14) That a new course, AMS 373 Advanced Insurance and Actuarial Practices, be approved as presented.

AMS 373 Advanced Insurance and Actuarial Practices
This course is a study of cash flow projection methods for pricing, reserving and profit testing. Topics include: deterministic, stochastic and stress testing; pricing and risk management of embedded options in insurance products; mortality and maturity guarantees for equity-linked life insurance.
Prerequsite/Co-Requisite: AMS 351
Semester Credit Hours: 3
CARRIED

15) That a new course, AMS 377 Combinatorial Optimization, be approved as presented.

AMS 377 Combinatorial Optimization
In this course, various algorithms will be considered, including minimum spanning tree, shortest path, maximum flow, and maximum matching. The links with linear and integer programming will also be considered, with particular attention to duality.
Prerequsite/Co-Requisite: Math 242 and Math 294
Semester Credit Hours: 3
CARRIED

16) That the following course be approved as presented.

AMS 408 Financial Mathematics II
This course explores calculus in a stochastic environment. Topics include: random functions, derivative, chain rule, integral, integration by parts, partial derivatives, pricing forwards and options. Ito's lemma and financial applications, Hull-White, Artzner-Heath, and Brennan-Schwartz models Martingales, pricing methodology, and risk-neutral probability will also be discussed.
Prerequsite/Co-Requisite: Math 261 and AMS 341
Semester Credit Hours: 3
CARRIED

17) That a new course, AMS 409 Financial Mathematics III, be approved as presented.

AMS 409 Financial Mathematics III
This course discusses forming risk-free portfolios, the Black-Scholes partial differential equation, constant dividend case, exotic options, drift adjustment, and equivalent martingale measures. Topics also include: Cox-Ross-Rubinstein, Merton and Vasicek's models, stochastic optimization, Hamilton-Jacobi-Bellman equation, and application to American options.
Prerequsite/Co-Requisite: AMS 408 and Stat 322
Semester Credit Hours: 3
CARRIED

18) That a new course, AMS 454 Loss Models I, the following course be approved as presented.

AMS 454 Loss Models I
This course explores models for loss severity, parametric models, effect of policy modifications, and tail behaviour. Topics also include: models for loss frequency: (a, b, 0), (a, b, 1), mixed Poisson models; compound Poisson models, Aggregate claims models: moments and moment generating function: recursion and Classical ruin theory.
Prerequsite/Co-Requisite: AMS 351 and Stat 322
Semester Credit Hours: 3
CARRIED

19) That a new course, AMS 455 Loss Models II, be approved as presented.

AMS 455 Loss Models II
This course is a study of the mathematics of survival models and includes some examples of parametric survival models. Topics include: tabular survival models, estimates from complete and incomplete data samples, parametric survival models, and determining the optimal parameters. Maximum likelihood estimators, derivation and properties, product limit estimators, Kaplan-Meier and Nelson-Aalen, credibility theory: limited fluctuation; Bayesian; Buhlmann; Buhlmann-Straub; empirical Bayes parameter estimation; statistical inference for loss models; maximum likelihood estimation; the effect of policy modifications; and model selection will also be discussed.
Prerequsite/Co-Requisite: AMS 454
Semester Credit Hours: 3
CARRIED

20) That a new course, AMS 458 Credibility Theory, be approved as presented.

AMS 458 Credibility Theory
This course is a credibility approach to inference for heterogeneous data; classical, regression and Bayesian models; with illustrations from insurance data.
Prerequsite/Co-Requisite: AMS 351 and Stat 322
Semester Credit Hours: 3
CARRIED

21) That a new course, AMS 468 Nonlinear Optimization, be approved as presented.

AMS 468 Nonlinear Optimization
This course is a study of unconstrained optimization, optimality conditions (necessary, sufficient

and Karush-Kuhn-Tucker), penalty functions, convex functions, and convex programming.
Prerequsite/Co-Requisite: Math 291 and AMS 294
Semester Credit Hours: 3
CARRIED

22) That a new course, AMS 478 Quantitative Risk Management, be approved as presented.

AMS 478 Quantitative Risk Management
This course is an introduction to financial risk management. Topics include: risk measures, modeling for multivariate distributions and copulas, market, credit and operational risk. Advanced topics in quantitative risk management will also be discussed.
Prerequsite/Co-Requisite: AMS 331
Semester Credit Hours: 3
CARRIED

23) That the deletion of the course CS 423 be approved.
CARRIED

24) That the new course CS 384 be approved as proposed.

CS 384 Technology Management & Entrepreneurship
This course provides an overview on how to start and sustain a technology-oriented company. Topics discussed will include the role of technology in society, intellectual property, patents, business plans, financial planning, sources of capital, business structure, liability, tax implications, sales, marketing, operational and human resource management. This course will be taught using problem-based and experiential learning strategies with involvement from real life entrepreneurs as motivators and facilitators.
Cross-Listing: ENGN443
Prerequsite/Co-Requisite: CS252, CS262 and CS282
Semester Credit Hours: 3
CARRIED

5) That the new course CS412 be approved as proposed.

CS 412 Machine Learning and Data Mining
Machine learning is the study of mechanisms for acquiring knowledge from large data sets. This course examines techniques for detecting patterns in sets of uncategorized data. Supervised and unsupervised learning techniques are studied, with particular application to real-world data.
Prerequsite/Co-Requisite: CS371 and STAT 221, CS 262 and CS 282
Semester Credit Hours: 3
CARRIED

26) That the new course CS484 be approved as proposed.

CS 484 Prototype Systems Development
This course is for student teams who wish to develop an early prototype of a product which they hope to pitch to an external start-up accelerator program post-graduation. Student teams may be inter-disciplinary, but students must register for this course (or its equivalent) within their home school/department. Entry into the course is dependent upon a pitch for the product being judged

as economically viable by a team of project mentors. Pitches are made at the conclusion of CS384.
Prerequsite/Co-Requisite: CS384 and permission of the instructor
Semester Credit Hours: 6
CARRIED

27) That the changes to the requirements for an Honours in Computer Science be approved as presented.

Honours in Computer Science
Revised
REQUIREMENTS FOR HONOURS IN COMPUTER SCIENCE

~~The Honours program in Computer Science is designed to provide research experience at the undergraduate level. It is intended for students who are planning to pursue postgraduate studies in Computer Science or a related discipline, or who are planning a career where research experience would be an asset.~~

~~The program requires a total of 126 semester hours of course credit. A total of 63 semester hours of Computer Science is required: 45 semester hours of core courses, a 6-semester-hour Honours project (CS 490), plus 12 semester hours of electives above the 100 level, at least 3 semester hours of which must be at the 400 level. The core consists of Computer Science 151-152, 161, 252, 261, 262, 282, 332, 342, 352, 361, 371, 411, 421, and 481. All core courses have three semester hours of credit. The required Mathematics courses are: Mathematics 151-152, 221, 242, 251, and 261.~~

~~Also required are 6 semester hours of credit from Biology, Chemistry or Physics, 9 semester hours of credit from the Faculty of Arts (including one of UPEI 101, UPEI 102, or UPEI 103 and one writing intensive course), and 3 semester hours of credit from the School of Business Administration. An additional 9 semester hours of credit must be selected from either the Faculty of Science (other than Computer Science) or the School of Business Administration. Students are strongly encouraged to complete some of the Science and Business courses early in their program.~~

~~To graduate with Honours in Computer Science, students must achieve a minimum average of 75% in all Computer Science courses combined, and must achieve a minimum overall average of 70% in all courses submitted for the the degree. In addition, all core Computer Science courses listed require 60% as a minimum grade and all Computer Science courses which are listed as prerequisites must have a minimum mark of 60%.~~

~~The specific courses are listed below:~~

	~~Semester hours of credit~~
~~First Year~~	
~~Computer Science 151-152~~	~~6~~
~~Computer Science 161~~	~~3~~
~~Mathematics 151-152~~	~~6~~
~~One of UPEI 101, UPEI 102, or UPEI 103~~	~~3~~
~~Science Electives~~	~~6~~
~~Business & Arts Elective~~	~~6~~
~~Second Year~~	
~~Computer Science 252~~	~~3~~

~~Computer Science 261~~	~~3~~
~~Computer Science 262~~	~~3~~
~~Computer Science 282~~	~~3~~
~~Mathematics 242~~	~~3~~
~~Mathematics 251~~	~~3~~
~~Mathematics 261~~	~~3~~
~~Electives~~	~~9~~

~~Third Year~~

~~Computer Science 332~~	~~3~~
~~Computer Science 342~~	~~3~~
~~Computer Science 352~~	~~3~~
~~Computer Science 361~~	~~3~~
~~Computer Science 371~~	~~3~~
~~Computer Science Elective~~	~~3~~
~~Mathematics 221~~	~~3~~
~~Electives~~	~~9~~

~~Fourth Year~~

~~Computer Science 411~~	~~3~~
~~Computer Science 421~~	~~3~~
~~Computer Science 481~~	~~3~~
~~Computer Science Electives~~	~~9~~
~~Computer Science 490 (Honours Research Project)~~	~~6~~
~~Electives~~	~~12~~
~~Total~~	~~126~~

~~ENTRANCE REQUIREMENTS~~

~~Permission of the Department is required for admission to the program. Students must normally have a minimum average of 70% in all previous courses. The Department expects first-class or high second-class standing in all previous Computer Science courses. Admission is contingent upon the student finding a project advisor. Students interested in doing Honours are strongly encouraged to consult with the Department Chair as soon as possible, and no later than January 31 of the student's third year. Students admitted to the program need acceptance by the Department of a topic for the Honours roject by March 31 of their third year.~~

The Honours in Computer Science requires a total of 126 semester hours of credit, as described below:

	Credits
The Common Core	23
CS 161 Digital Systems	3
CS 252 Computer Organization and Architecture	3
CS 261 Data Structures and Algorithms	3
CS 262 Comparative Programming Languages	3
CS 282 Programming Practices	3
MATH 242 Combinatorics I	3
MATH 291 Multivariable Calculus	4
MCS 332 Theory of Computing	3
CS 342 Computer Communications	3
CS 352 Operating Systems	3

CS 361 Analysis and Design of Algorithms	3
CS 362 Software Design and Architecture	3
CS 371 Database Systems	3
At least one of	
CS 411 Artificial Intelligence and Automated Reasoning	
or	
CS 412 Machine Learning	3
CS 481 Software Engineering	3
MCS 490 Honours Research Project	6
Four electives in the Mathematical and Computational Sciences (at the 200 level or higher)	12
MCS 305 Tutoring in Mathematical and Computational Sciences	1
MCS 421 Professional Communication and Practice	3
Additional general electives	35
Total Semester Hours of Credit	**126**

CARRIED

28) That the changes to the requirements for a Major in Computer Science be approved as presented.

Major in Computer Science

Revised

REQUIREMENTS FOR A MAJOR IN COMPUTER SCIENCE

~~The program requires a total of 120 semester hours of course credit. A total of 51 semester hours of Computer Science is required: 45 semester hours of core courses, plus 6 semester hours of electives above the 100 level. The core consists of Computer Science 151 152, 161, 252, 261, 262, 282, 332, 342, 352, 361, 371, 421, 481, and 482. To receive credit towards a Major in Computer Science, all core computer science courses listed require 60% as a minimum grade and all Computer Science courses which are listed as prerequisites must have a minimum mark of 60%. All core courses have three semester hours of credit. The required Mathematics courses are: Mathematics 191 192, 221, 242, and 261.~~

~~Also required are 6 semester hours of credit from Biology, Chemistry or Physics; 9 semester hours of credit from the Faculty of Arts; One of UPEI 101, 102, or 103 and one writing intensive course, and 3 semester hours of credit from the School of Business Administration. An additional 9 semester hours of credit must be selected from either the Faculty of Science (other than Computer Science and Information Technology) or the School of Business Administration. Students are strongly encouraged to complete some of the Science and Business courses early in their program.~~

~~**NOTE:** Students majoring in computer science with a specialization should consult their specific requirements, which differ from the normal requirements listed above.~~

~~The following sequence of courses is suggested:~~

~~**First Year**~~

- ~~Computer Science 151 152~~
- ~~Computer Science 161~~
- ~~Mathematics 191 192~~
- ~~One of UPEI 101, 102, or 103~~
- ~~Science Electives (6 semester hours)~~
- ~~Business and Arts Electives (6 semester hours)~~

~~**Second Year**~~

- ~~Computer Science 252~~
- ~~Computer Science 261~~
- ~~Computer Science 262~~
- ~~Computer Science 282~~
- ~~Mathematics 242~~
- ~~Mathematics 261~~
- ~~Electives (9 semester hours)~~

~~Third Year~~

- ~~Computer Science 332~~
- ~~Computer Science 342~~
- ~~Computer Science 352~~
- ~~Computer Science 361~~
- ~~Computer Science 371~~
- ~~Mathematics 221~~
- ~~Electives (12 semester hours)~~

~~Fourth Year~~

- ~~Computer Science 421~~
- ~~Computer Science 481~~
- ~~Computer Science 482~~
- ~~Computer Science Electives (6 semester hours)~~
- ~~Electives (15 semester hours)~~

~~Minor in Computer Science~~

~~Students may obtain a minor in Computer Science by completing at least 21 semester hours of courses in Computer Science defined as follows:~~

- ~~CS 151-152 Introduction to Computer Science I & II~~
- ~~CS 252 Computer Organization and Architecture~~
- ~~CS 261 Data Structures and Algorithms~~
- ~~plus 3 semester hours of Computer Science at the 300 level or above, and an additional 6 semester hours of Computer Science at the 200 level or above.~~

The Major in Computer Science requires a total of 120 semester hours of credit, as described below:

	Credits
The Common Core	23
CS 161 Digital Systems	3
CS 252 Computer Organization and Architecture	3
CS 261 Data Structures and Algorithms	3
CS 262 Comparative Programming Languages	3
CS 282 Programming Practices	3
MATH 242 Combinatorics I	3
MCS 332 Theory of Computing	3
CS 342 Computer Communications	3
CS 352 Operating Systems	3
CS 361 Analysis and Design of Algorithms	3
CS 362 Software Design and Architecture	3
CS 371 Database Systems	3
CS 481 Software Engineering	3
One of:	
CS 482 Software Systems Development Project	

or	
CS 484 Prototype Systems Development	6
Two electives in Mathematical & Computational Sciences(at the 200 level or higher)	6
MCS 305 Tutoring in Mathematical & Computational Sciences	1
MCS 421 Professional Communication and Practice	3
Additional general electives:	
if CS482 taken	45
or	
if CS484 taken	42
Total Semester Hours of Credit	**120**

CARRIED

29) That the changes to the requirements for a Major in Computer Science with a Specialization in Video Game Programming be approved as presented.

Major in Computer Science with a Specialization in Video Game Programming

~~**SPECIALIZATIONS**~~

~~The department offers specializations in core areas of computer science and departmental expertise. Specializations provide the student with a suggested course of study concentrating in a particular field of computer science.~~

~~**VIDEO GAME PROGRAMMING**~~

~~To achieve a specialization in Video Game Programming, the student must complete the following courses in addition to the normal requirements for a major in computer science: IT 132, CS 212, CS 222, CS 311, CS 435, CS 436 and CS 465. In addition, students must take CS 483 instead of CS 482.~~

~~Students wishing to pursue a specialization in Video Game Programming must apply for admission to the specialization at the end of their second year. Students must have an overall average of 75% and cannot have a mark less than 70% in any of the courses CS 152, CS 261 and CS 212.~~

~~Students pursuing the specialization must maintain an overall average of 75% in subsequent terms. Furthermore, students in the specialization cannot receive a mark of less than 70% in the courses CS 311, CS 435 and CS 436.~~

~~The above requirements may be waived in exceptional cases by a decision of the department.~~

The Major in Computer Science with a specialization in Video Game Programming requires a total of 120 semester hours of credit, as described below:

	Credits
The Common Core	23
CS 161 Digital Systems	3
At least one of	
CS 212 Mobile Device Development –iOS	
or	
CS 213 Mobile Device Development-Android	3
CS 252 Computer Organization and Architecture	3
CS 261 Data Structures and Algorithms	3
CS 262 Comparative Programming Languages	3

CS 282 Programming Practices	3
MATH 242 Combinatorics I	3
CS 311 Video Game Design	3
MCS 332 Theory of Computing	3
CS 342 Computer Communications	3
CS 352 Operating Systems	3
CS 361 Analysis and Design of Algorithms	3
CS 362 Software Design and Architecture	3
CS 371 Database Systems	3
CS 435 Computer Graphics Programming	3
CS 436 Advanced Computer Graphics Programming	3
At least two of	
CS 406 Cloud Computing	
CS 412 Machine Learning and Data Mining	
CS 444 Data Science	
or	
CS 461 Wireless Sensor Networks	6
CS 465 Video Game Architecture	3
CS 481 Software Engineering	3
CS 483 Video Game Programming Project	6
Two electives in the Mathematical and Computational Sciences (at the 200 level or higher)	6
MCS 305 Tutoring in Mathematical & Computational Sciences	1
MCS 421 Professional Communication and Practice	3
Additional general electives	21
Total Semester Hours of Credit	**120**

CARRIED

30 - 33) That courses IT132, IT321, IT371, Math 480, 485 and 491-492 be deleted.
CARRIED

34) That Math 262, Linear Algebra II, be approved as presented.

Math 262 – Linear Algebra II
This course continues MATH 261 with further concepts and theory of linear algebra. Topics include vector spaces, orthogonality, Gram-Schmidt Process, canonical forms, spectral decompositions, inner product spaces and the projection theorem.
Prerequisite/Co-Requisite: Math 191, Math 261
Semester Credit Hours: 3
CARRIED

35) That a new course, Math 343 Combinatorics II, be approved as presented.

Math 343 – Combinatorics II
This course continues MATH 242, with the examination of advanced counting techniques, binomial coefficients, and generating functions. Other topics include relations, partial orders, and Steiner Triple systems.
Prerequisite/Co-Requisite: Math242
Semester Credit Hours: 3

CARRIED

36) That Math 453, Functional Analysis, be approved as presented.

Math 453 – Functional Analysis
This first course in functional analysis covers topics like: metric spaces, Banach spaces, function spaces, Hilbert spaces, generalized Fourier series and linear operators.
Prerequisite/Co-Requisite: Math 262 and Math 351
Semester Credit Hours: 3
CARRIED

37) That the course name, description and prerequisite changes for Math 242, and be approved as proposed.

Math 242
Math 242 ~~DISCRETE MATHEMATICS~~ COMBINATORICS I
This course offers a survey of topics in discrete mathematics that are essential for students majoring in ~~Mathematics or Computer Science~~ the Mathematical and Computational Sciences. ~~Topics include logic; proof techniques such as mathematical induction; counting methods; algorithms and big-Oh notation; introductory graph theory; and Boolean algebras.~~
Topics include: logic, proof techniques such as mathematical induction, recursion, counting methods, and introductory graph theory.
PREREQUISITE: Math ~~152~~ 192
Three lecture hours a week
CARRIED

38) That the course name and prerequisite changes to Math 261 be approved as proposed.

Math 261 – Linear Algebra I
This course introduces some of the basic concepts and techniques of linear algebra to students of any major. The emphasis is on the interpretation and development of computational tools. Theory is explained mainly on the basis of two or three-dimensional models. Topics covered are: matrices; determinants; systems of equations; vectors in two and three-dimensional space including dot and cross products, lines, and planes; concepts of linear independence, basis, and dimension explained with examples; linear transformations and their matrices; eigenvectors and eigenvalues.
Prerequisite: ~~Six semester hours of First Year Mathematics~~ Grade XII academic Mathematics
Three lectures hours a week
CARRIED

39) That the name and course description changes to Math 361 be approved as proposed

Math 361 – Group Theory
Math 361 ~~ABSTRACT ALGEBRA I~~ GROUP THEORY
~~This is a first course in abstract (modern) algebra in which several different algebraic structures are introduced. Topics covered include: the concept of a group, elementary group properties, subgroups, cyclic groups, permutation groups, cosets, normal subgroups, homomorphisms, the concept of a ring, subrings, ideals, polynomial rings, the concepts of field and vector space.~~
An introduction to group theory, including: cyclic groups, symmetric groups, subgroups and

normal subgroups, Lagrange's theorem, quotient groups and homomorphisms, isomorphism theorems, group actions, Sylow's theorem, simple groups, direct and semidirect products, fundamental theorem on finitely generated Abelian groups.
PREREQUISITE: Math 272
Three lecture hours a week
CARRIED

40) That the name and course description changes to Math 452 be approved as proposed.

Math 452 – Measure Theory and Integration
Math 452 ~~REAL ANALYSIS II~~ MEASURE THEORY AND INTEGRATION
~~This course follows directly from Mathematics 351. Topics include: the Riemann-Stieltjes Integral, series tests for convergence and divergence, sequences and series of functions, special functions, and topics chosen from functions of several variables, integration of differential forms, the Lebesgue Theory, and metric spaces.~~ A first course in measure theory, covering measure as a generalization of length, outer measure, sigma-algebras, measurability, construction of measures, Lebesgue measure on the real line, measurable functions and the Lebesgue integral. Additional topics may include and convergence theorems, product measures and Fubini Theorem.
PREREQUISITE: Math 351
Three lecture hours a week
CARRIED

41) That the name and course description changes to Math 462 be approved as proposed.

Math 462 – Ring and Field Theory
Math 462 ~~ABSTRACT ALGEBRA II~~ RING AND FIELD THEORY
~~This is a second course in abstract algebra which continues the study of abstract algebraic structures which was introduced in Mathematics 361. Topics include: quotient groups, group homomorphisms and automorphisms, direct products, the de- composition of finite abelian groups, ideals and quotient rings, field of quotients of an integral domain, Euclidean rings and principal ideal domains, rings of polynomials, unique factorization domains, extension fields.~~
Introduction to ring and field theory, including: polynomial rings, matrix rings, ideals and homomorphisms, quotient rings, Chinese remainder theorem, Euclidean domains, principal ideal domains, unique factorization domains, introduction to module theory, basic theory of field extensions, splitting fields and algebraic closures, finite fields, introduction to Galois theory.
PREREQUISITE: Math 361
Three lecture hours a week
CARRIED

42) That the changes to the Requirements for an Honours in Mathematics be approved as presented.

Honours in Mathematics
REQUIREMENTS FOR HONOURS IN MATHEMATICS
~~The Honours program in Mathematics is designed to provide research experience at the undergraduate level. It is intended for students who are planning to pursue postgraduate studies in Mathematics or a related discipline, or who are planning a career where research experience would be an asset.~~

The Honours program requires a total of 126 semester hours of course credit, as described below: ~~A total of 60 semester hours of Mathematics are required: 39 semester hours of core courses, a 6-semester-hour Honours project (Math 480), plus 15 semester hours of electives above the 100 level, at least 3 semester hours of which must be at the 400 level. The core consists of Math 191-192, 221, 242, 261, 272, 291, 301, 321, 331, 351, and 361. Also required are one of UPEI 101, UPEI 102, or UPEI 103 and one writing intensive course, Computer Science 151-152, and an additional 15 semester hours of courses offered by the Faculty of Science. Physics 111-112 is highly recommended. Students are strongly encouraged to take some of the science courses early in their program. To graduate with the Honours in Mathematics, students must achieve a minimum average of 75% in all Mathematics courses combined, and must achieve a minimum overall average of 70% in all courses submitted for the degree.~~

~~**Note:** For the academic year 2015/16 only, Math 251 and 252 (and 253 for Engineering students) will be offered to those students who currently already have taken Math 151 and 152 and who require second year calculus courses for their degree requirements. Students entering in the fall of 2015 will be expected to take Math 191 and 192 in their first year of studies. Math 251, 252 and 253 will be deleted from the course offerings in Mathematics in 2016/17 and only Math 191, 192 and 291 will be offered. Students who have completed any of Math 151, 152, 251, 252 or 253 should be aware that courses requiring Calculus prerequisites now have Math 191, 192 or 291 listed as prerequisites in this calendar. Generally Math 151 can be substituted for Math 191, Math 192 can be substituted for Math 152 and Math 251 and 252 or Math 253 can be substituted for Math 291 to satisfy the perquisites. However, this is a general rule only and students should check with the course instructors to determine prerequisite substitutions for a particular course.~~

~~The specific courses required are listed below:~~

	~~**Semester hours of credit**~~
~~First Year~~	
~~Mathematics 191-192~~	~~8~~
~~Computer Science 151-152~~	~~6~~
~~Electives~~	~~18~~
~~Second Year~~	
~~Mathematics 221~~	~~3~~
~~Mathematics 242~~	~~3~~
~~Mathematics 291~~	~~4~~
~~Mathematics 261~~	~~3~~
~~Mathematics 272~~	~~3~~
~~Electives~~	~~12~~
~~Third & Fourth Year~~	
~~Mathematics 301~~	~~3~~
~~Mathematics 321~~	~~3~~
~~Mathematics 331~~	~~3~~
~~Mathematics 351~~	~~3~~
~~Mathematics 361~~	~~3~~
~~Mathematics 480 (Honours project)~~	~~6~~
~~Mathematics Electives~~	~~15~~
~~Electives~~	~~30~~
~~Total~~	~~126~~

	Credits
The Common Core	23
MATH 291 Multivariable Calculus	4
MATH 222 Introductory Statistics II	3
MATH 262 Linear Algebra II	3
MATH 272 Mathematical Reasoning	3
At least one of	
MCS 201 MAPLE Technology Lab	
or MCS 202 Matlab Technology Lab	1
MATH 242 Combinatorics I	3
MATH 351 Real Analysis	3
MATH 361 Group Theory	3
MATH 301 Differential Equations,	3
STAT 321 Probability and Mathematical Statistics I	3
MATH 331 Complex Variables	3
MCS 490 Honours Project	6
Four electives in Mathematical and	
Computational Sciences (at the 200 level	
or higher with at least two at the 400 level or higher)	12
MCS 305 Tutoring in Mathematical & Computational Sciences	1
MCS 421 Professional Communication and Practice	3
Additional general electives	49
Total Semester Hours of Credit	**126**

CARRIED

43) That the changes to the Requirements for a Major in Mathematics be approved as presented.

Major in Mathematics

REQUIREMENTS FOR A MAJOR IN MATHEMATICS

The Major program requires a total of 120 semester hours of ~~course~~ credit, as described below:

~~A total of 45 semester hours of Mathematics is required: 33 semester hours of core courses, plus 12 semester hours of electives above the 100 level, at least 6 semester hours of which must be above the 200 level. The core consists of Math 191 192, 221, 242, 261, 272, 291, 351, 361, plus at least one of 301, 321, or 331. Also required are one of UPEI 101, UPEI 102, or UPEI 103 and one writing intensive course, Computer Science 151 152 and an additional 15 semester hours of courses offered by the Faculty of Science. Physics 111-112 is highly recommended. Students are strongly encouraged to take some of the science courses early in their program.~~

~~**Note:** For the academic year 2015/16 only, Math 251 and 252 (and 253 for Engineering students) will be offered to those students who currently already have taken Math 151 and 152 and who require second year calculus courses for their degree requirements. Students entering in the fall of 2015 will be expected to take Math 191 and 192 in their first year of studies. Math 251, 252 and 253 will be deleted from the course offerings in Mathematics in 2016/17 and only Math 191, 192 and 291 will be offered. Students who have completed any of Math 151, 152, 251, 252 or 253 should be aware that courses requiring Calculus prerequisites now have Math 191, 192 or 291 listed as prerequisites in this calendar. Generally Math 151 can be substituted for Math 191, Math~~

~~192 can be substituted for Math 152 and Math 251 and 252 or Math 253 can be substituted for Math 291 to satisfy the perquisites. However, this is a general rule only and students should check with the course instructors to determine prerequisite substitutions for a particular course.~~

~~The specific courses (and semester hours of credit) required are:~~

~~First Year~~	~~**Semester hours of credit**~~
~~Mathematics 191-192~~	~~8~~
~~Computer Science 151-152~~	~~6~~
~~Electives~~	~~18~~
~~Second Year~~	
~~Mathematics 221~~	~~3~~
~~Mathematics 242~~	~~3~~
~~Mathematics 291~~	~~4~~
~~Mathematics 261~~	~~3~~
~~Mathematics 272~~	~~3~~
~~Electives~~	~~12~~
~~Third & Fourth Year~~	
~~At least one of~~	~~3~~
~~Mathematics 301, 321, or 331~~	
~~Mathematics 351~~	~~3~~
~~Mathematics 361~~	~~3~~
~~Mathematics Electives~~	~~12~~
~~Electives~~	~~39~~
~~Total~~	~~120~~

	Credits
The Common Core	23
MATH 291 Multivariable Calculus	4
MATH 222 Introductory Statistics II	3
MATH 262 Linear Algebra II	3
MATH 272 Mathematical Reasoning	3
At least one of	
MCS 201 MAPLE Technology Lab	
or MCS 202 Matlab Technology Lab	1
MATH 242 Combinatorics I	3
MATH 351 Real Analysis	3
MATH 361 Group Theory	3
At least one of	
MATH 301 Differential Equations,	
STAT 321 Probability and Mathematical Statistics I	
or MATH 331 Complex Variables	3
Five electives in Mathematical and	
Computational Sciences (at the 200 level	
or higher with at least two at the 300 level	
or higher)	15
MCS 305 Tutoring in Mathematical & Computational Sciences	1

MCS 421 Professional Communication and Practice	3
Additional general electives	52
Total Semester Hours of Credit	**120**

CARRIED

44) That the changes to the requirements for a Minor in Mathematics be approved as presented.

Minor in Mathematics

REQUIREMENTS FOR A MINOR IN MATHEMATICS

Students may obtain a minor in Mathematics by completing at least ~~21~~ 24 semester hours of courses credit in Mathematics defined as follows:

		~~Semester Hours~~ **Credit**
Math 191-192 Introductory Single Variable Calculus I & II		8
~~Math 291 Multivariable and Vector Intermediate Calculus I~~		~~4~~
Math 261	Linear Algebra	3
Math 291	Multivariable Calculus	4
Plus 3 semester hours of Mathematics at the 300 level or above, and an additional ~~3~~ 6 semester hours of Mathematics at the 200 level or above		**9**
Total Semester Hours of Credit		24

CARRIED

45) That the changes to the Requirements for a Major in Mathematics with Engineering be approved as presented.

REQUIREMENTS FOR A MAJOR IN MATHEMATICS WITH ENGINEERING

~~Students enrolled in the Engineering Diploma Program may follow an expanded program leading to the Bachelor of Science degree with a major in Mathematics. Students must fulfil all requirements for a Diploma in Engineering, as well as the additional requirements for a Major in Mathematics specified below.~~

~~The Mathematics with Engineering program requires a total of 120 semester hours of course credit. A total of 36 semester hours of Mathematics is required: Math 191-192, 221, 261, 272, 291, 301, 331, one of 351 and 361, and 6 semester hours of mathematics electives at the 300 level or above. All of the required courses for a Diploma in Engineering must be completed, specifically: Engineering 121, 122, 132, 151, 221, 222, 231, 261 and 281; and six semester hours of Engineering electives.~~

~~Also required is one of Computer Science 161 or 392. Additional Science are: Physics 111 and 112, and Chemistry 111 and 112. The remaining electives must include one of UPEI 101, UPEI 102, or UPEI 103 and one writing intensive course required by the University.~~

~~**Note:** For the academic year 2015/16 only, Math 251 and 252 (and 253 for Engineering students) will be offered to those students who currently already have taken Math 151 and 152 and who require second year calculus courses for their degree requirements. Students entering in the fall of 2015 will be expected to take Math 191 and 192 in their first year of studies. Math 251, 252 and 253 will be deleted from the course offerings in Mathematics in 2016/17 and only Math 191, 192 and 291 will be offered. Students who have completed any of Math 151, 152, 251, 252 or 253 should be aware that courses requiring Calculus prerequisites now have Math 191, 192 or 291 listed as prerequisites in this calendar. Generally Math 151 can be substituted for Math 191, Math 192 can be substituted for Math 152 and Math 251 and 252 or Math 253 can be substituted for Math 291 to satisfy the perquisites. However, this is a general rule only and students should check with the course instructors to determine prerequisite substitutions for a particular course.~~

~~The specific courses required are listed below:~~

~~First Year~~	~~**Semester hours of credit**~~
~~Mathematics 191-192~~	~~8~~
~~Engineering 121-122~~	~~6~~
~~Engineering 132~~	~~3~~
~~Engineering 151~~	~~3~~
~~Physics 111-112~~	~~6~~
~~Chemistry 111-112~~	~~6~~
~~Second Year~~	
~~Mathematics 291~~	~~4~~
~~Mathematics 261~~	~~3~~
~~Mathematics 272~~	~~3~~
~~Engineering 221, 222~~	~~6~~
~~Engineering 231~~	~~3~~
~~Engineering 261~~	~~3~~
~~Engineering 281~~	~~3~~
~~Computer Science 241 or 392~~	~~3~~
~~Mathematics 301~~	~~3~~
~~Mathematics 331~~	~~3~~
~~Mathematics 351 or 361~~	~~3~~
~~Mathematics Electives~~	~~6~~
~~Engineering Electives~~	~~6~~
~~UPEI 101, 102, or 103~~	~~3~~
~~Electives~~	~~33~~
~~Total~~	~~120~~

The Major in Mathematics with Engineering requires a total of 120 semester hours of credit, as described below:

	Credits
The Common Core	23
MATH 291 Multivariable Calculus	4
MATH 222 Introductory Statistics II	3
MATH 262 Linear Algebra II	3

MATH 272 Mathematical Reasoning	3
MATH 301 Differential Equations	3
MATH 331 Complex Variables	3
At least one of	
MATH 351 Real Analysis or	
MATH 361 Group Theory	3
Two electives in Mathematical and Computational Sciences	
(at the 300 level or higher)	6
PHYS 111 and 112 General Physics I and II	6
CHEM 111 and 112 General Chemistry I and II	6
ENGN 121 Design 1: Engineering Communications	3
ENGN 122 Design 2: Engineering Analysis	3
ENGN 151 Engineering and the Biosphere	3
ENGN 221 Design 3: Engineering Projects I	3
ENGN 222 Design 4: Engineering Projects II	3
ENGN 231 Strength of Materials	3
ENGN 234 Engineering Dynamics	3
ENGN 261 Thermofluids I	3
ENGN 281 Electrical Circuits I	3
Two electives in Engineering	6
Additional general electives	24
Total Semester Hours of Credit	**120**

CARRIED

46) That the new course MCS 201 be approved as presented.

MCS 201 Maple Lab in Mathematics
An introduction to the software package MAPLE. Topics include the basic functions and commands, mathematical problem solving using MAPLE, and programming in the internal MAPLE language. Two lab hours per week for 6 weeks.
Prerequisite/Co-requisite: CS151 and Math 192
Semester Credit Hours: 1
CARRIED

47) That a new course, MCS 202 MATLAB Technology Lab, be approved as presented.

MCS 202 MatLab Technology Lab
An introduction to the software package Matlab. Topics include the basic functions and commands, programming and problem-solving using Matlab. Two lab hours per week for 6 weeks.
Prerequisite/Co-requisite: Math 261 and CS 151
Semester Credit Hours: 1
CARRIED

48) That a new course, MCS 203 R Technology Lab, be approved as presented.

MCS 203 R Technology Lab
An introduction to the software package R. Topics include the basic functions and commands, programming and problem-solving using R. Two lab hours per week for 6 weeks.

Prerequisite/Co-requisite: Stat 222 and CS 151
Semester Credit Hours: 1
CARRIED

49) That a new course, MCS 204 Visual Basic in Excel Technology Lab, be approved as presented.

MCS 204 Visual Basic In Excel Technology Lab
An introduction to the software package Excel and Visual Basic in the Excel environment. Topics include the basic functions and commands, programming and problem-solving using Excel and Visual Basic. Two lab hours per week for 6 weeks.
Prerequisite/Co-requisite: CS151 and AMS 240
Semester Credit Hours: 1
CARRIED

50) That a new course, MCS 205 GGY Axis Technology Lab, be approved as presented.

MCS 205 GGY Axis Technology Lab
An introduction to the software package GGY AXIS. Topics include the basic functions and commands, programming and problem-solving using GGY AXIS. Two lab hours per week for 6 weeks.
Prerequisite/Co-requisite: AMS 251 and CS 151
Semester Credit Hours: 1
CARRIED

51) That a new course, MCS 284 Co-op Career Skills I, be approved as presented.

MCS 284 Co-Op Career Skills I
This course offers introductory career skills training to prepare co-op students for their first work term. Students are assessed on a pass/fail basis. Cross-listed with Business (cf. Business 292).
Cross-Listing: Business 292
Prerequisite/Co-requisite: Acceptance into the Mathematical and Computational Sciences Cooperative Education Program
Semester Credit Hours: 0
CARRIED

52) That a new course, MCS 285 Co-op Work Term I, be approved as presented.

MCS 285 Co-Op Work Term I
This course is a co-op student's first work term. A work term report related to a technical problem/issue within the organization where the student is working is required. Students will be assessed on a pass/fail basis.
Prerequisite/Co-requisite: MCS 284 or permission of the Academic Director of Co-operative Education
Semester Credit Hours: 3
CARRIED

53) That a new course, MCS 305 Tutoring in Mathematical and Computational Sciences, be approved as presented.

MCS 305 Tutoring in Mathematical and Computational Sciences
Students are introduced to techniques for facilitating learning in the Mathematical and Computational Sciences, and then put these techniques into practice by mediating student group learning either in introductory Mathematical and Computational Sciences courses, Mathematical and Computational Science Help Centre or in outreach programs to High Schools.
Prerequisite/Co-requisite: At least 36 semester hours of credit completed in the School of Mathematical and Computational Sciences
Semester Credit Hours: 1
CARRIED

54) That a new course, MCS 350 Quantum Information, be approved as presented.

MCS 350 Quantum Information
This course is an introduction to quantum information science; the field of studying, storing, processing and communicating information using quantum systems. Topics include: quantum mechanics for Qubit Systems, foundations of Quantum Computing, algorithms, communication and cryptography.
Prerequisite/Co-requisite: Math 262
Semester Credit Hours: 3
CARRIED

55) That a new course, MCS 384 Co-op Career Skills II, be approved as presented.

MCS 384 Co-Op Career Skills II
This course offers career skills training to strengthen co-op students' readiness for their second work term. Cross-listed with Business (cf. Business 392)
Cross-Listing: Business 392
Prerequisite/Co-requisite: MCS 285
Semester Credit Hours: 0
CARRIED

56) That a new course, MCS 385 Co-op Work Term II, be approved as presented.

MCS 385 Co-Op Work Term II
This course is a co-op students' second work term. Students will submit a report summarizing their work term achievements.
Prerequisite/Co-requisite: MCS 384 or permission of the Academic Director of Co-operative Education.
Semester Credit Hours: 3
CARRIED

57) That a new course, MCS 395 Special Topics in Mathematical and Computational Sciences, be approved as presented.

MCS 395 Special Topics in Mathematical and Computational Sciences
This course provides students with an opportunity to pursue special topics in Mathematical and Computational Science. Content varies from year to year.
Prerequisite/Co-requisite: Permission of the Instructor
Semester Credit Hours: 3
CARRIED

58) That a new course, MCS 421 Professional Communication and Practice, be approved as presented.

MCS 421 Professional Communication and Practice
This course aims to build students' oral and written communications skills, and to prepare them for a professional environment. Using examples from their discipline, students will focus on such aspects as description of processes, presentation of data, extended abstracts, correct use of terminology, and sensitivity to language and tone. Discussions of topics relevant to the professional Mathematical and Computational Scientist are also a key part of the course.
Prerequisite/Co-requisite: At least 36 semester hours of credit completed in the School of Mathematical and Computational Sciences
Semester Credit Hours: 3
CARRIED

59) That a new course, MCS 442 Cryptography and Codes, be approved as presented.

MCS 422 Cryptography and Codes
This course is a study of classic and modern methods of encryption, applications to public-key ciphers, random number generators, attacks on encryption systems, error correcting codes; and computational number theory.
Prerequisite/Co-requisite: Math 342
Semester Credit Hours: 3
CARRIED

60) That a new course, MCS 484 Co-op Career Skills III, be approved as presented.

MCS 484 Co-Op Career Skills III
This course offers career skills training to strengthen co-op students' readiness for their third work term. Cross-listed with Business (cf. Business 492).
Cross-Listing: Business 492
Prerequisite/Co-requisite: MCS 385
Semester Credit Hours: 0
CARRIED

61) That a new course, MCS 485 Co-op Work Term III, be approved as presented.

MCS 485 Co-Op Work Term III
This course is a co-op students' third work term. Students will submit a report summarizing their work term achievements. Students are assessed on a pass/fail basis.
Prerequisite/Co-requisite: MCS 484 or permission of the Academic Director of Co-operative Education
Semester Credit Hours: 3
CARRIED

62) That a new course, MCS 486 Co-op Work Term IV, be approved as presented.

MCS 486 Co-Op Work Term IV
This optional work term is only available to co-op students in the School of Mathematical and Computational Sciences, who elect for a fourth work term. The goal is to add further value for the student, integrating classroom theory with professional skills acquired during the work term.
Prerequisite/Co-requisite: MCS 485

Semester Credit Hours: 0
CARRIED

63) That a new course, MCS 490 Honours Project, be approved as presented.

MCS 490 Honours Project
This course is intended to give research experience to students planning to pursue graduate studies in an area of Mathematical and Computational Sciences, or planning a career where research experience would be an asset. It provides students with the opportunity to do an independent research project on a Mathematical or Computational Sciences topic, under the supervision of a faculty member. Some or all of the work may be done during the summer months.
Prerequisite/Co-requisite: Acceptance to an Honours program in the School of Mathematical and Computational Sciences
Semester Credit Hours: 6
CARRIED

64) That a new course, MCS 491 Directed Studies in Mathematical and Computational Sciences, be approved as presented.

MCS 491 Directed Studies in Mathematical and Computational Sciences
These courses are designed and recommended for students in the Mathematical and Computational Sciences to encourage independent initiative and study. Reading and research will be conducted in one or more specialized areas.
(See Academic Regulation 9 for Regulations Governing Directed Studies.)
Prerequisite/Co-requisite: Permssion of the Instructor
Semester Credit Hours: 3
CARRIED

65) That a new course, MCS 495 Advanced Topics in Mathematical and Computational Sciences, be approved as presented.

MCS 495 Advanced Topics in Mathematical and Computational Sciences
This course provides students with an opportunity to pursue advanced topics in Mathematical and Computational Sciences. Content varies from year to year but is always at a fourth-year level. Prospective students should contact the School of Mathematical and Computational Sciences for a more detailed description of any particular year's offering.
Prerequisite/Co-requisite: Permission of the Instructor
Semester Credit Hours: 3
CARRIED

66) That Math 392/CS392 be changed to MCS 392 and the cross-listing with Computer Science be deleted.

~~Math~~ MCS 392 NUMERICAL ANALYSIS
Approximate solution of equations, various interpolative or iterative methods, especially Newton's; convergence tests and rates of convergence; roundoff and truncation errors; propagation of error in calculations; interpolating polynomials; Gauss-Jordan and other methods for simultaneous linear equations; inversion of matrices; determinants and eigenvalues; simultaneous nonlinear equations; evaluation of definite integrals; approximate derivatives; initial-value ordinary differential equations; least-squares curve fitting.

~~Cross-listed with Computer Science (cf. Computer Science 392)~~
PREREQUISITE: Math 301, and CS 151 or equivalent
Three lecture hours a week
CARRIED

67) That a new course, Stat 411 Statistical Simulation, be approved as presented.

Stat 411 Statistical Simulation
This course introduces statistical simulation, and its use as a tool to investigate stochastic phenomena and statistical methods. Topics include the building and validation of stochastic simulation models useful in computing, operations research, engineering and science; related design and estimation problems; variance reduction; and the implementation and the analysis of the results.
Prerequisite/Co-Requisite: Stat 322
Semester Credit Hours: 3
CARRIED

68) That a new course, Stat 428 Generalized Linear Models, be approved as presented.

Stat 428 Generalize Linear Models
This course covers the basic theory, methodology and applications of generalized linear models. Topics include logistic regression, probit regression, binomial regression, Poisson regression, overdispersion, quasi-likelihood, and the exponential family.

Prerequisite/Co-Requisite: Stat 322 and Stat 324
Semester Credit Hours: 3
CARRIED

69) That a new course, Stat 433 Time Series I, be approved as presented.

Stat 433 Time Series I
This course is an introduction to Time Series methods, including: stationary models, trends and seasonality, stochastic Time Series models, autoregressive and moving average processes and an introduction to Time Series forecasting. ARIMA models. Seasonal Time Series and Spectral Analysis are also covered.
Prerequisite/Co-Requisite: Stat 324
Semester Credit Hours: 3
CARRIED

70) That a new course, Stat 434 Time Series III, be approved as presented.

Stat 434 Times Series II
This course includes topics from Time Series Econometrics, including Maximum Likelihood and Least Squares Estimation of ARIMA Models and GARCH Models, Wavelets and Financial Models. Non-stationary Time Series, multivariate Time Series and panel cointegration analysis are also covered.
Prerequisite/Co-Requisite: Stat 433
Semester Credit Hours: 3
CARRIED

71) That a new course, Stat 441 Stochastic Processes, be approved as presented.

Stat 441 Stochastic Processes
This course is an introduction to the branch of probability theory that deals with the analysis of systems that evolve over time. Topics include random walks, Markov chains, Poisson processes, continuous time Markov chains, birth and death processes, exponential models, and applications of Markov chains.
Prerequisite/Co-Requisite: Stat 322
Semester Credit Hours: 3
CARRIED

72) That a new course, Stat 455 Data Analysis and Interference, be approved as presented.

Stat 455 Data Analysis and Interference
This course is an introduction to data analysis with a focus on regression. Topics include: initial examination of data, correlation, and simple and multiple regression models using least squares. Inference for regression parameters, confidence and prediction intervals, diagnostics and remedial measures interactions and dummy variables, variable selection, least squares estimation and inference for non-linear regression will also be discussed.
Prerequisite/Co-Requisite: Stat 324
Semester Credit Hours: 3
CARRIED

73) That a new course, Stat 466 Data Visualization and Mining, be approved as presented.

Stat 466 Data Visualization and Mining
This course introduces students to the statistical methods involved in visualization of high dimensional data, including interactive methods directed at exploration and assessment of structure and dependencies in data. Topics include methods for finding groups in data including cluster analysis, dimension reduction methods including multi-dimensional scaling, pattern recognition, and smoothing techniques.
Prerequisite/Co-Requisite: Math 262, Math 291 and Stat 321
Semester Credit Hours: 3
CARRIED

74) That a new course, Stat 474 Multivariate Analysis, be approved as presented.

Stat 474 Multivariate Analysis
This course deals with the statistics of observation and analysis of more than one output variable. Topics include estimation and hypothesis testing for multivariate normal data, principal component analysis and factor analysis, discriminant analysis, cluster analysis, and correspondence analysis.
Prerequisite/Co-Requisite: Stat 324
Semester Credit Hours: 3
CARRIED

75) That the prefix for Math 221 be changed to Stat 221, the prerequisite be changed, and that the change to the Note in the calendar entry be approved as proposed.

~~Math~~ Stat 221 INTRODUCTORY STATISTICS I
The main objective of this course is to introduce the basic concepts of descriptive statistics, statistical inference, and the use of statistical software such as MINITAB to students in any discipline. More time is

spent on statistical inference than on descriptive statistics. Topics include frequency distributions, descriptive statistics, rules of probability, discrete and continuous probability distributions, random sampling and sampling distributions, confidence intervals, one- and two-tail tests of hypotheses, and correlation and linear regression.
PREREQUISITE: Grade XII academic Mathematics. ~~Three semester hours of university mathematics is strongly recommended~~
Three lecture hours a week
NOTE: A student will not get credit for Stat 221 if the student has received credit for any of the following courses: Business 251, Education 481, Psychology 271 and Sociology 332.
CARRIED

76) That the changes to Math 222 including the change in the prefix to Stat and the prerequisite change be approved as proposed.

~~Math~~ Stat 222 INTRODUCTORY STATISTICS II
The course builds upon the knowledge developed in Introductory Statistics I and introduces students to statistical techniques commonly used in research. Topics include linear regression and multiple linear regression, residual analysis, simple ANOVA models, categorical data analysis, simple sampling models, and common distributions (including binomial, Poisson, and exponential).
PREREQUISITE: ~~Math~~ Stat 221
Three lecture hours per week
CARRIED

77) That the changes to Math 321 including the change to the Stat designation, course description and prerequisite change be approved as proposed.

~~Math~~ Stat 321 PROBABILITY AND MATHEMATICAL STATISTICS I
This course is an introduction to the theoretical basis of statistics for students who have completed Introductory Statistics. The study concentrates on the mathematical tools required to develop statistical methodology. ~~Topics covered include: probability, random variables, functions of random variables, expectation, probability distributions, and sampling distributions.~~ Topics covered include: probability, continuous and discrete random variables, moment generating functions, multivariate probability distributions and functions of random variables.
PREREQUISITE: Math ~~152~~ 291, and ~~Math~~ Stat ~~221~~ 222 or permission of the instructor.
Three lecture hours a week
CARRIED

78) That the prefix for Math 322 be changed to Stat 322, the course description change and the prerequisite change be approved as proposed.

~~Math~~ Stat 322 PROBABILITY AND MATHEMATICAL STATISTICS II
This course builds on the mathematical foundation developed in Mathematics 321 and introduces the student to the theory of statistical inference. ~~Topics covered include sampling, further discussion of sampling distributions, parametric point and interval estimation, tests of hypothesis, an introduction to Bayesian, linear, and nonparametric methods.~~ Topics covered include: sampling distributions and central limit theory, methods of estimation, hypothesis testing, least squares estimation of linear models, and an introduction to Bayesian inference.
PREREQUISITE: ~~Math 252 and Math 321~~ Stat 321 Three lecture hours a week
CARRIED

79) That the prefix for Math 324 be changed to Stat 324, the course description change and the prerequisite change be approved as proposed.

Revised

~~Math~~ Stat 324 APPLIED REGRESSION ANALYSIS

This course builds upon the basis of inference studied in ~~Math~~ Stat 221 and provides students with an advanced knowledge of regression techniques. Topics covered are simple and multiple linear regression techniques, matrix notation, the design matrix, model building techniques, residual analysis, and non-linear regression.

PREREQUISITE: ~~Math~~ Stat 221 and Math 261

Three lecture hours a week

CARRIED

80) That the prefix for Math 424 be changed to Stat 424 and the course description and prerequisite changes be approved as proposed.

~~Math~~ Stat 424 EXPERIMENTAL DESIGN

This course builds upon the basis of inference studied in ~~Math~~ Stat 221 and ~~Math~~ Stat 324 to include statistical techniques commonly used in experimental studies. Students will study topics such as analysis of variance models, hypothesis testing in ANOVA models, randomization, and blocking techniques.

PREREQUISITE: ~~Math~~ Stat 324

Three lecture hours a week

CARRIED

81) That a new Major in Statistics be approved as presented.

Major in Statistics

The Major in Statistics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
MCS 203	R Technology Lab	1
STAT 222	Introductory Statistics II	3
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
STAT 455	Data Analysis and Inference	3
STAT 424	Experimental Design	3
STAT 433	Time Series I	3
STAT 411	Statistical Simulation	3
STAT 441	Stochastic Processes	3
Two electives in the Mathematical and Computational Sciences (at the 200 level or higher)		6
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		49
Total Semester Hours of Credit		**120**

CARRIED

82) That a new Honours in Statistics be approved as presented.

Honours in Statistics

REQUIREMENTS FOR HONOURS IN STATISTICS

The Honours in Statistics program requires a total of 126 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
MCS 203	R Technology Lab	1
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics I	3
STAT 324	Applied Regression Analysis	3
STAT 455	Data Analysis and Inference	3
STAT 424	Experimental Design	3
STAT 433	Time Series I	3
STAT 411	Statistical Simulation	3
STAT 441	Stochastic Processes	3
MSC 490	Honours Project	6
Two electives in the Mathematical and Computational Science (at the 300 level or higher)		6
MCS 305	Tutoring in Mathematical & Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		49
Total Semester Hours of Credit		**126**

CARRIED

83) That a Minor in Statistics be approved as presented.

Minor in Statistics

REQUIREMENTS FOR A MINOR IN STATISTICS

Students may obtain a Minor in Statistics by completing ~~the following courses~~ at least 23 semester hours of credit in Mathematics and Statistics defined as follows:

MATH 191-192 Introductory Single Variable Calculus I & II ~~(8 semester hours)~~	8
~~Math~~ STAT 221-222 Introductory Statistics I & II ~~(6 semester hours)~~	6
MATH 261 Linear Algebra I ~~(3 semester hours)~~	3
~~Math~~STAT 321 Probability and Mathematical Statistics ~~I~~ ~~(3 semester hours)~~	3
~~One additional Statistics Course chosen from Math 324, 322, or 424 (3 semester hours)~~ plus 3 semester hours of credit in Statistics at the 300 level or higher	3
Total Semester Hours of Credit	**23**

~~NOTE:~~ ~~Students majoring in Mathematics are not allowed to minor in Statistics. Consult with the Department regarding specializations within the mathematics major~~

CARRIED

84) That the new Major in Actuarial Science be approved as presented.

Major in Actuarial Science

The Major in Actuarial Science requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
MATH 301	Differential Equations	3
At least one of	MCS 202 Matlab Technology Lab	
	MCS 204 Visual Basic in Excel Technology Lab	
	Or MCS 205 GGY AXIS Technology Lab	1
AMS 216	Mathematics of Finance	3
AMS 240	Financial Mathematics & Investments	3
AMS 241	Financial Economics I	3
AMS 341	Financial Economics II	3
AMS 251	Actuarial Science I	3
AMS 351	Actuarial Science II	3
AMS 331	Advanced Corporate Finance for Actuaries	3
AMS 373	Advanced Insurance and Actuarial Practices	3
AMS 454	Loss Models I	3
AMS 455	Loss Models II	3
AMS 458	Credibility Theory	3
STAT 411	Statistical Simulation	3
STAT 433	Time Series I	3
STAT 441	Stochastic Processes	3
MCS 392	Numerical Analysis	3
ECON 101	Introductory Microeconomics	3
ECON 102	Introductory Macroeconomics	3
ACCT 101	Introduction to Accounting	3
BUS 231	Corporate Finance	3
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		10
Total Semester Hours of Credit		**120**

CARRIED

85) That a new Major in Financial Mathematics be approved as presented.

Major in Financial Mathematics

REQUIREMENTS FOR A MAJOR IN FINANCIAL MATHEMATICS

The Major in Financial Mathematics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
STAT 222	Introductory Statistics II	3
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
At least one of	MCS 202 Matlab Technology Lab MCS 203 R Technology Lab or MCS 204 Visual Basic in Excel Technology Lab	1
AMS 216	Mathematics of Finance	3
AMS 240	Financial Mathematics & Investments	3
AMS 241	Financial Economics I	3
AMS 341	Financial Economics II	3
AMS 408	Financial Mathematics II	3
AMS 409	Financial Mathematics III	3
AMS 478	Quantitative Risk Management	3
AMS 391	Mathematical Modelling	3
AMS 331	Advanced Corporate Finance for Actuaries	3
MATH 301	Differential Equations	3
MATH 351	Real Analysis	3
MATH 471	Partial Differential Equations	3
STAT 433	Time Series I	3
At least one of	STAT 441 Stochastic Processes or MATH 392 Numerical Analysis	3
ECON 101	Introductory Microeconomics	3
ECON 102	Introductory Macroeconomics	3
At least one of	ECON 251 Money and Financial Institutions Or ECON 405 Financial Economics	3
ACCT 101	Introduction to Accounting	3
BUS 231	Corporate Finance	3
At least one of	BUS 333 Integrated Cases in Corporate Finance BUS 366 Entrepreneurial Finance BUS 421 Personal Finance BUS439 International Finance or BUS 482 International Strategy and Finance	3
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		10
Total Semester Hours of Credit		**120**

CARRIED

86) That a new Major in Analytics (Specialization in Data Analytics) be approved as presented.

Major in Analytics (Specialization in Data Analytics)

The Major in Analytics with a specialization in Data Analytics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
At least one of	MCS 201 MAPLE Technology Lab MCS 202 Matlab Technology Lab or MCS 203 R Technology Lab	1
MATH 242	Combinatorics I	3
MATH 343	Combinatorics II	3
AMS 294	Optimization	3
AMS 377	Combinatorial Optimization	3
AMS 391	Mathematical Modelling	3
MATH 301	Differential Equations	3
MATH 361	Group Theory	3
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
STAT 455	Data Analysis and Inference	3
STAT 466	Data Visualization and Mining	3
CS 261	Data Structures and Algorithms	3
CS 371	Database Systems	3
CS 361	Analysis and Design of Algorithms	3
CS 412	Machine Learning	3
CS 444	Data Science	3
Three	electives in Mathematical or Computational Sciences (at the 200 level or higher)	9
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		19
Total Semester Hours of Credit		**120**

CARRIED

87) That a new Major in Analytics (Specialization in Business Analytics) be approved as presented.

Major in Analytics (Specialization in Business Analytics)

The Major in Analytics with a specialization in Business Analytics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
At least one of	MCS 201 MAPLE Technology Lab	

	MCS 202 Matlab Technology Lab or	
	MCS 203 R Technology Lab	1
MATH 242	Combinatorics I	3
MATH 343	Combinatorics II	3
AMS 294	Optimization	3
AMS 377	Combinatorial Optimization	3
AMS 391	Mathematical Modelling	3
MATH 301	Differential Equations	3
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
STAT 466	Data Visualization and Mining	3
Three electives in the Mathematical and Computational Sciences		
	(at the 300 level or higher)	9
CS 261	Data Structures and Algorithms	3
CS 371	Database Systems	3
ACCT 101	Introduction to Financial Accounting	3
BUS 141	Marketing	3
BUS 171	Organizational Behaviour	3
At least five of		
	ACCT 221 Managerial Accounting	
	BUS 265 Introduction to Entrepreneurship …	
	BUS 288 Research and Evidence-Based Management	
	BUS 272 Human Resource Management	
	BUS 301 Business Law	
	BUS 333 Integrated Cases in Corporate Finance	
	BUS 351 Operations Management	
	BUS 371 Entrepreneurship and New Ventures	
	BUS 465 Project Management or	
	BUS 488 Developing Management Skills	15
	MCS 305 Tutoring in Mathematical and Computational Sciences	1
	MCS 42Professional Communication and Practice	3
	Additional general electives	10
Total Semester Hours of Credit		**120**

CARRIED

Note: Students who complete the Major in Analytics with a specialization in Business Analytics and obtain grades of at least 60% in seven of the Business courses can also obtain a Certificate in Business.

88) **To delete the existing calendar entries for Computer Science and Mathematics and Statistics, and to replace them with a new calendar entry for Mathematical and Computational Sciences as presented.**

New Calendar entry for Mathematical and Computational Sciences
Mathematical and Computational Sciences
www.upei.ca/school_mcs

Mathematical and Computational Sciences Faculty
Gordon MacDonald, Professor, Interim Associate Dean
Maxim Burke, Professor

Cezar Câmpeanu, Professor
Louis Doiron, Professor
Nasser Saad, Professor
Ken Sulston, Professor
Shannon Fitzpatrick, Associate Professor
David Horrocks, Associate Professor
Stephen Howard, Associate Professor
Shafiqul Islam, Associate Professor
Sami Khedhiri, Associate Professor
David LeBlanc, Associate Professor
Qiang Ye, Associate Professor
Andrew Godbout, Assistant Professor
Yingwei Wang, Assistant Professor
Scott Bateman, Adjunct Professor

Overview
The School of Mathematical and Computational Sciences at UPEI provides students with a strong foundation in Mathematics, Statistics and Computer Science, and offers a comprehensive suite of applied programs which meet market demand and lead to fulfilling careers in areas such as: Financial Mathematics, Actuarial Science, Data Analytics, Business Analytics and Video Game Programming.

Faculty members in the School of Mathematical and Computational Sciences are focused on providing quality instruction in a friendly learning community. Small class sizes, active-learning opportunities and accessible professors are features of all programs in the School of Mathematical and Computational Sciences.

The School of Mathematical and Computational Sciences offers degrees in:

- **Mathematics Major and Honours,**
- **Statistics Major and Honours,**
- **Computer Science Major and Honours**
- **Computer Science Major, specializing in Video Game Programming,**
- **Actuarial Science Major,**
- **Financial Mathematics Major,**
- **Analytics Major, specializing in Data Analytics,**
- **Analytics Major, specializing in Business Analytics,**
- **Mathematics with Engineering Major.**

Mathematics
Mathematics is the study of number, quantity and space. Mathematics can be studied for its own sake (usually called pure mathematics) or as it is applied to other disciplines. The **Bachelor of Science with a Major in Mathematics** provides students with a solid foundation in both pure and applied mathematics, without any particular applied specialization. Graduates of this program are well situated for graduate programs in Mathematics, post-Bachelor professional programs (Education, Law, Medicine, Business, etc.), or applied Mathematical Sciences programs. Students interested in continuing on to work in mathematics research should consider the **Bachelor of Science with Honours in Mathematics.**

Statistics
Statistics is the practice of collecting and analyzing numerical data, and inferring properties of the whole from a representative sample. The **Bachelor of Science with a Major in Statistics** provides students with

the solid foundation in both statistical theory and applied statistics necessary to become a Statistician or to proceed to more specialized Statistical study at the graduate level. Students interested in continuing to work in statistics research should consider the **Bachelor of Science with Honours in Statistics.**

Computer Science
Computer Science is the practice of understanding, designing, and automating algorithmic processes. The **Bachelor of Science with a Major in Computer Science** provides students with a solid foundation in both the principles and practice of computing. Graduates of this program are well situated for graduate programs in Computer Science or entering the workforce. Students interested in continuing on to work in computer Science research should consider the **Bachelor of Science with Honours in Computer Science.**

Actuarial Science
Actuarial Science is the study of risk, usually risk associated with insurance, pension and investment plans. Actuarial Science uses techniques from mathematics, statistics and finance. The **Bachelor of Science with a Major in Actuarial Science** provides students with the education required to become an Actuary.

Financial Mathematics
Financial Mathematics is the application of mathematical models to finance, usually to analyze markets and pricing. Financial Mathematics uses techniques from Mathematics, Statistics, Business and Economics. The **Bachelor of Science in Financial Mathematics** provides a solid foundation in Financial Mathematics, leading either to a career in the financial sector or to further training in advanced Financial Mathematics.

Analytics
Analytics is the application of techniques from Mathematical and Computational Sciences to discover meaningful patterns in data. The **Bachelor of Science in Analytics** has two specializations: **Business Analytics**, which focuses particularly on business data, and using analytics to improve business performance, and **Data Analytics,** which focuses on the examining large amounts of raw for the purpose of drawing conclusions about that information.

Computer Science specializing in Video Game Programming
Video Game Programming involves mathematical and problem solving skills in addition to programming and design of video games on traditional and non-traditional platforms. The **Bachelor of Science in Computer Science with a specialization in Video Game Programming** provides students with the specialized skills to enter this growing field.

Mathematics with Engineering
The School of Mathematical and Computational Sciences offers the opportunity to obtain a Mathematics degree in conjunction Engineering courses offered through UPEI's School of Sustainable Design Engineering. The **Bachelor of Science in Mathematics with Engineering** provides a foundational Engineering program combined with more advanced mathematical training than is received in an Engineering Degree program.

COURSE CODE PREFIXES
In the School of Mathematical and Computational Sciences, there are five course prefixes:
MATH – for Mathematics courses
STAT – for Statistics courses
CS – for Computer Science courses
AMS – for Applied Mathematical Sciences courses (mainly Actuarial Science and Financial Mathematics)

MCS – for common or interdisciplinary courses in Mathematical and Computational Science

COMMON REQUIREMENTS ACROSS ALL DEGREE PROGRAMS IN THE SCHOOL OF MATHEMATICAL AND COMPUTATIONAL SCIENCES

COMMON CORE

All degree programs in the School of Mathematical and Computational Sciences are built on a common core of courses that should be completed in the first two years of study. This common core consists of the following courses:

			Credits
MATH 191		Single Variable Calculus I	4
MATH 192		Single Variable Calculus II	4
MATH 261		Linear Algebra I	3
STAT 221		Introductory Statistics I	3
CS 151		Introduction to Computer Science I	3
CS 152		Introduction to Computer Science II	3
One of	UPEI 101	Writing Studies	
	UPEI 102	Inquiry Studies	
	UPEI 103	University Studies	3
Total Semester Hours of Credit			**23**

ADVANCED COMMON CORE COURSES

Students in all degree programs in the School of Mathematical and Computational Sciences must complete:

	Credits
MCS 421 Professional Communication and Practice (writing-intensive)	3
and MCS 305 Tutoring in Mathematical and Computational Sciences	1

COMMON BREADTH REQUIREMENT

Students must take at least 15 semester hours of credit beyond the core course requirement in courses outside the School of Mathematical and Computational Sciences, and of these 15 semester hours of credit, at least 6 must be from Biology, Chemistry or Physics and at least 6 must be from outside the Faculty of Science.

REQUIREMENTS FOR A MAJOR IN MATHEMATICS

The Major in Mathematics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
At least one of	MCS 201 MAPLE Technology Lab or	
	MCS 202 Matlab Technology Lab	1
MATH 242	Combinatorics I	3
STAT 222	Introductory Statistics II	3
MATH 351	Real Analysis	3
MATH 361	Group Theory	3
At least one of		

MATH 301	Differential Equations,	
STAT 321	Probability and Mathematical Statistics I or	
MATH 331	Complex Variables	3
Five electives in the Mathematical and Computational Sciences		15
(at the 200 level or higher with at least two at the 300 level or higher)		
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		52
Total Semester Hours of Credit		**120**

REQUIREMENTS FOR A MAJOR IN STATISTICS

The Major in Statistics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
MCS 203	R Technology Lab	1
STAT 222	Introductory Statistics II	3
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
STAT 455	Data Analysis and Inference	3
STAT 424	Experimental Design	3
STAT 433	Time Series I	3
STAT 411	Statistical Simulation	3
STAT 441	Stochastic Processes	3
Two electives in the Mathematical and Computational Sciences		
	(at the 200 level or higher)	6
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		49
Total Semester Hours of Credit		**120**

REQUIREMENTS FOR A MAJOR IN COMPUTER SCIENCE

The Major in Computer Science requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
CS 161	Digital Systems	3
CS 252	Computer Organization and Architecture	3
CS 261	Data Structures and Algorithms	3
CS 262	Comparative Programming Languages	3
CS 282	Programming Practices	3
MATH 242	Combinatorics I	3
MCS 332	Theory of Computing	3
CS 342	Computer Communications	3
CS 352	Operating Systems	3

CS 361	Analysis and Design of Algorithms	3
CS 362	Software Design and Architecture	3
CS 371	Database Systems	3
CS 481	Software Engineering	3
One of:		
	CS 482 Software Systems Development Project	3
or	CS 484 Prototype Systems Development	6
Two electives in Mathematical and Computational Sciences		
	(at the 200 level or higher)	6
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives:	if CS 482 taken	45
	or if CS 484 taken	42
Total Semester Hours of Credit		**120**

REQUIREMENTS FOR A MAJOR IN ACTUARIAL SCIENCE

The Major in Actuarial Science requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
STAT 321	Probability and Mathematical Statistics I	
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
MATH 301	Differential Equations	3
At least one of	MCS 202 Matlab Technology Lab	
	MCS 204 Visual Basic in Excel Technology Lab	
or	MCS 205 GGY AXIS Technology Lab	1
AMS 216	Mathematics of Finance	3
AMS 240	Financial Mathematics & Investments	3
AMS 241	Financial Economics I	3
AMS 341	Financial Economics II	3
AMS 251	Actuarial Science I	3
AMS 351	Actuarial Science II	3
AMS 331	Advanced Corporate Finance for Actuaries	3
AMS 373	Advanced Insurance and Actuarial Practices	3
AMS 454	Loss Models I	3
AMS 455	Loss Models II	3
AMS 458	Credibility Theory	3
STAT 411	Statistical Simulation	3
STAT 433	Time Series I	3
STAT 441	Stochastic Processes	3
MCS 392	Numerical Analysis	3
ECON 101	Introductory Microeconomics	3
ECON 102	Introductory Macroeconomics	3
ACCT 101	Introduction to Accounting	3

BUS 231	Corporate Finance	3
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		10
Total Semester Hours of Credit		**120**

REQUIREMENTS FOR A MAJOR IN FINANCIAL MATHEMATICS

The Major in Financial Mathematics requires a total of 120 semester hours of credit, as described below:

			Credits
The Common Core			23
MATH 291	Multivariable and Vector Calculus		4
MATH 262	Linear Algebra II		3
MATH 272	Mathematical Reasoning		3
STAT 222	Introductory Statistics II		3
STAT 321	Probability and Mathematical Statistics I		3
STAT 322	Probability and Mathematical Statistics II		3
STAT 324	Applied Regression Analysis		3
At least one of	MCS 202	Matlab Technology Lab	
	MCS 203	R Technology Lab	
	or MCS 204	Visual Basic in Excel Technology Lab	1
AMS 216	Mathematics of Finance		3
AMS 240	Financial Mathematics & Investments		3
AMS 241	Financial Economics I		3
AMS 341	Financial Economics II		3
AMS 408	Financial Mathematics II		3
AMS 409	Financial Mathematics III		3
AMS 478	Quantitative Risk Management		3
AMS 391	Mathematical Modelling		3
AMS 331	Advanced Corporate Finance for Actuaries		3
MATH 301	Differential Equations		3
MATH 351	Real Analysis		3
MATH 471	Partial Differential Equations		3
STAT 433	Time Series I		3
At least one of	STAT 441	Stochastic Processes	
or MATH 392	Numerical Analysis		3
ECON 101	Introductory Microeconomics		3
ECON 102	Introductory Macroeconomics		3
At least one of	ECON 251	Money and Financial Institutions	
	or ECON 405	Financial Economics	3
ACCT 101	Introduction to Accounting		3
BUS 231	Corporate Finance		3
At least one of	BUS 333	Integrated Cases in Corporate Finance	
	BUS 366	Entrepreneurial Finance	
	BUS 421	Personal Finance	
	BUS439	International Finance	
	or BUS 482	International Strategy and Finance	3
MCS 305	Tutoring in Mathematical and Computational Sciences		1
MCS 421	Professional Communication and Practice		3
Additional general electives			10

Total Semester Hours of Credit		**120**

REQUIREMENTS FOR A MAJOR IN ANALYTICS (Specialization in Data Analytics)

The Major in Analytics with a specialization in Data Analytics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
At least one of	MCS 201 MAPLE Technology Lab	
	MCS 202 Matlab Technology Lab	
	or MCS 203 R Technology Lab	1
MATH 242	Combinatorics I	3
MATH 343	Combinatorics II	3
AMS 294	Optimization	3
AMS 377	Combinatorial Optimization	3
AMS 391	Mathematical Modelling	3
MATH 301	Differential Equations	3
MATH 361	Group Theory	3
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
STAT 455	Data Analysis and Inference	3
STAT 466	Data Visualization and Mining	3
CS 261	Data Structures and Algorithms	3
CS 371	Database Systems	3
CS 361	Analysis and Design of Algorithms	3
CS 412	Machine Learning	3
CS 444	Data Science	3
Three	electives in Mathematical or Computational Sciences (at the 200 level or higher)	9
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		19
Total Semester Hours of Credit		**120**

REQUIREMENTS FOR A MAJOR IN ANALYTICS (Specialization in Business Analytics)

The Major in Analytics with a specialization in Business Analytics requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
At least one of	MCS 201 MAPLE Technology Lab	

	MCS 202	Matlab Technology Lab	
	or MCS 203	R Technology Lab	1
MATH 242	Combinatorics I		3
MATH 343	Combinatorics II		3
AMS 294	Optimization		3
AMS 377	Combinatorial Optimization		3
AMS 391	Mathematical Modelling		3
MATH 301	Differential Equations		3
STAT 321	Probability and Mathematical Statistics I		3
STAT 322	Probability and Mathematical Statistics II		3
STAT 324	Applied Regression Analysis		3
STAT 466	Data Visualization and Mining		3
Three electives in the Mathematical and Computational Sciences			
		(at the 300 level or higher)	9
CS 261	Data Structures and Algorithms		3
CS 371	Database Systems		3
ACCT 101	Introduction to Financial Accounting		3
BUS 141	Marketing		3
BUS 171	Organizational Behaviour		3
At least five of	ACCT 221	Managerial Accounting	
	BUS 265	Introduction to Entrepreneurship …	
	BUS 288	Research and Evidence-Based Management	
	BUS 272	Human Resource Management	
	BUS 301	Business Law	
	BUS 333	Integrated Cases in Corporate Finance	
	BUS 351	Operations Management	
	BUS 371	Entrepreneurship and New Ventures	
	BUS 465	Project Management or	
	BUS 488	Developing Management Skills	15
MCS 305	Tutoring in Mathematical and Computational Sciences		1
MCS 421	Professional Communication and Practice		3
Additional general electives			10
Total Semester Hours of Credit			**120**

Note: Students who complete the Major in Analytics with a specialization in Business Analytics and obtain grades of at least 60% in seven of the Business courses can also obtain a Certificate in Business.

REQUIREMENTS FOR A MAJOR IN MATHEMATICS WITH ENGINEERING

The Major in Mathematics with Engineering requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
MATH 301	Differential Equations	3
MATH 331	Complex Variables	3

At least one of	MATH 351 Real Analysis	
or	MATH 361 Group Theory	3
Two electives in Mathematical and Computational Sciences		
	(at the 300 level or higher)	6
PHYS 111 and 112	General Physics I and II	6
CHEM 111 and 112	General Chemistry I and II	6
ENGN 121	Design 1: Engineering Communications	3
ENGN 122	Design 2: Engineering Analysis	3
ENGN 151	Engineering and the Biosphere	3
ENGN 221	Design 3: Engineering Projects I	3
ENGN 222	Design 4: Engineering Projects II	3
ENGN 231	Strength of Materials	3
ENGN 234	Engineering Dynamics	3
ENGN 261	Thermofluids I	3
ENGN 281	Electrical Circuits I	3
Two electives in Engineering		6
Additional general electives		24
Total Semester Hours of Credit		**120**

Note:

- Mathematics with Engineering Majors may substitute ENGN 132 for CS 151, and CS 161 or MCS 392 for CS 152.

REQUIREMENTS FOR A MAJOR IN COMPUTER SCIENCE (Specialization in Video Game Programming)

The Major in Computer Science with a specialization in Video Game Programming requires a total of 120 semester hours of credit, as described below:

		Credits
The Common Core		23
CS 161	Digital Systems	3
At least one of	CS 212 Mobile Device Development –iOS	
	or CS 213 Mobile Device Development- Android	3
CS 252	Computer Organization and Architecture	3
CS 261	Data Structures and Algorithms	3
CS 262	Comparative Programming Languages	3
CS 282	Programming Practices	3
MATH 242	Combinatorics I	3
CS 311	Video Game Design	3
MCS 332	Theory of Computing	3
CS 342	Computer Communications	3
CS 352	Operating Systems	3
CS 361	Analysis and Design of Algorithms	3
CS 362	Software Design and Architecture	3
CS 371	Database Systems	3
CS 435	Computer Graphics Programming	3
CS 436	Advanced Computer Graphics Programming	3
At least two of	CS 406 Cloud Computing	
	CS 412 Machine Learning	
	CS 444 Data Science	
	or CS 461 Wireless Sensor Networks	6

CS 465	Video Game Architecture	3
CS 481	Software Engineering	3
CS 483	Video Game Programming Project	6
Two electives in the Mathematical and Computational Sciences (at the 200 level or higher)		6
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		21
Total Semester Hours of Credit		**120**

ACCEPTANCE TO AN HONOURS PROGRAM

Students in the Mathematics, Statistics and Computer Science programs have an Honours option. Permission of the School of Mathematical and Computational Sciences is required for admission to an Honours program. Students must normally have a minimum average of 70% in all previous courses. Normally, the School expects an average of 75% in all previous Mathematical and Computational Sciences courses. Admission is contingent upon the student finding a project advisor and acceptance by the School of the topic for the Honours project. Students interested in doing Honours are strongly encouraged to consult with the Associate Dean of the School of Mathematical and Computational Sciences as soon as possible, and no later than January 31 of the student's third year**.** To receive the Honours designation, in addition to successful completion of the Honours project, normally students must maintain an average of at least 75% in all courses in the School of Mathematical and Computational Sciences.

REQUIREMENTS FOR HONOURS IN MATHEMATICS

The Honours in Mathematics program requires a total of 126 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
At least one of	MCS 201 MAPLE Technology Lab	
	or MCS 202 Matlab Technology Lab	1
MATH 242	Combinatorics I	3
MATH 351	Real Analysis	3
MATH 361	Group Theory	3
MATH 301	Differential Equations	3
STAT 321	Probability and Mathematical Statistics I	3
MATH 331	Complex Variables	3
MCS 490	Honours Project	6
Four electives in the Mathematical and Computational Sciences (at the 200 level or higher, with at least two at the 400 level or higher)		12
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		49
Total Semester Hours of Credit		**126**

REQUIREMENTS FOR HONOURS IN STATISTICS

The Honours in Statistics program requires a total of 126 semester hours of credit, as described below:

		Credits
The Common Core		23
MATH 291	Multivariable and Vector Calculus	4
STAT 222	Introductory Statistics II	3
MATH 262	Linear Algebra II	3
MATH 272	Mathematical Reasoning	3
MCS 203	R Technology Lab	1
STAT 321	Probability and Mathematical Statistics I	3
STAT 322	Probability and Mathematical Statistics II	3
STAT 324	Applied Regression Analysis	3
STAT 455	Data Analysis and Inference	3
STAT 424	Experimental Design	3
STAT 433	Time Series I	3
STAT 411	Statistical Simulation	3
STAT 441	Stochastic Processes	3
MCS 490	Honours Project	6
Two electives in the Mathematical and Computational Science (at the 300 level or higher)		6
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		49
Total Semester Hours of Credit		**126**

REQUIREMENTS FOR HONOURS IN COMPUTER SCIENCE

The Honours in Computer Science requires a total of 126 semester hours of credit, as described below:

		Credits
The Common Core		23
CS 161	Digital Systems	3
CS 252	Computer Organization and Architecture	3
CS 261	Data Structures and Algorithms	3
CS 262	Comparative Programming Languages	3
CS 282	Programming Practices	3
MATH 242	Combinatorics I	3
MATH 291	Multivariable Calculus	4
MCS 332	Theory of Computing	3
CS 342	Computer Communications	3
CS 352	Operating Systems	3
CS 361	Analysis and Design of Algorithms	3
CS 362	Software Design and Architecture	3
CS 371	Database Systems	3
At least one of	CS 411 Artificial Intelligence and Automated Reasoning or CS 412 Machine Learning	3
CS 481	Software Engineering	3
MCS 490	Honours Research Project	6
Four electives in the Mathematical and Computational Sciences (at the 200 level or higher)		12
MCS 305	Tutoring in Mathematical and Computational Sciences	1
MCS 421	Professional Communication and Practice	3
Additional general electives		35

Total Semester Hours of Credit	**126**

REQUIREMENTS FOR A MINOR IN MATHEMATICS

Students may obtain a Minor in Mathematics by completing at least 24 semester hours of credit in Mathematics defined as follows:

		Credits
MATH 191-192	Single Variable Calculus I & II	8
MATH 261	Linear Algebra I	3
MATH 291	Multivariable and Vector Calculus	4
plus	3 semester hours of credit in Mathematics at the 300 level or higher, and an additional 6 semester hours of credit of Mathematics at the 200 level or above.	9
Total Semester Hours of Credit		**24**

REQUIREMENTS FOR A MINOR IN STATISTICS

Students may obtain a Minor in Statistics by completing at least 23 semester hours of credit in Mathematics and Statistics defined as follows:

		Credits
MATH 191-192	Single Variable Calculus I & II	8
STAT 221-222	Introductory Statistics I & II	6
MATH 261	Linear Algebra I	3
STAT 321	Probability and Mathematical Statistics	3
plus	3 semester hours of credit in Statistics at the 300 level or higher	3
Total Semester Hours of Credit		**23**

REQUIREMENTS FOR A MINOR IN COMPUTER SCIENCE

Students may obtain a Minor in Computer Science by completing at least 21 semester hours of credit in Computer Science defined as follows:

		Credits
CS 151-152	Introduction to Computer Science I & II	6
CS 252	Computer Organization and Architecture	3
CS 261	Data Structures and Algorithms	3
plus	3 semester hours of credit in Computer Science at the 300 level or higher, and an additional 6 semester hours of credit in Computer Science at the 200 level or higher.	9
Total Semester Hours of Credit		**21**

MATHEMATICAL AND COMPUTATIONAL SCIENCES CO-OP PROGRAM

The Mathematical and Computational Sciences Co-op Program is an integrated approach to university education that enables students to alternate academic terms on campus with work terms in relevant and supervised employment. The Co-op Program consists of eight academic terms, at least three work terms and a series of professional development workshops and seminars. It is available as an option to full-time students enrolled in Major and Honours programs. Application to the co-op program is made in the student's second year of study. Students must complete 126 semester hours of credit to graduate with the Co-op designation, and no credit will be given for any Co-op work term course, unless at least three work terms are successfully completed.

See the Co-op Education (Mathematical and Computational Sciences) page for complete program details.

ADMISSION TO SCIENCE CALCULUS

The First-year Calculus courses for most science students are Math 191 and Math 192. In addition to Grade XII academic Mathematics (or equivalent), a passing grade on an Assessment Test written during the first week of classes is required as a prerequisite for Math 191. The Assessment Test covers the standard pre-calculus topics of the High School curriculum (arithmetic, algebra, trigonometry, analytic geometry and the basic theory of functions). This test is of 90 minutes duration and is given during the first week of classes. Students who do not pass the assessment test may have the option of enrolling in a special section of Math 191 incorporating additional tutorials reviewing pre-Calculus materials. See the Associate Dean of the School of Mathematical and Computational Sciences for details.

TRANSITION FROM MATH 151,152,251,252,253 TO MATH 191,192,291

The School of Mathematical and Computational Sciences is currently transitioning from a four-course (12 credit) Science Calculus stream to a three-course (12 credit) Science Calculus stream. This note clarifies some of the issues concerning this transition:

- During the 2015-2016 Academic Year, Math 191 and Math 192 will be the first-year Science Calculus course offered. Math 251 and Math 252 (or Math 253 for Engineering students) will be the second-year Science Calculus offered.
- During the 2016-2017 Academic Year, only Math 191, Math 192 and Math 291 will be offered.
- During the 2016-2017 Academic Year, students who have completed of Math 151 and Math 152 and wish to enroll in Math 291 must complete a transition course Math 185. The content of Math 191, 192 is equivalent to the content in Math 151, 152 and Math 185.
- Students may not count both Math 191 and Math 151 for credit.
- Students may not count Math 192 and either Math 152 or Math 251 for credit
- Students may not count Math 291 and any of Math 251, Math 252 or Math 253 for credit.
- Students who have completed any of Math 151, 152, 251, 252 or 253 should be aware that courses requiring Calculus prerequisites now have courses from Math 191, 192 or Math 291 listed as prerequisites in this calendar. Generally, Math 151 can be substituted for Math 191 to satisfy a prerequisite, Math 192 can be substituted for Math 152 to satisfy a prerequisite and Math 251 and 252 or Math 253 can be substituted for Math 291 to satisfy a prerequisite. This is a general rule only, students should check with instructors of courses to determine prerequisite substitutions for a particular course.

SELECTION OF COURSES

Students majoring in a program in the School of Mathematical and Computational Sciences may not use Math 101, Math 111 or Math 112 for credit towards the degree.

Students majoring in a program in the School of Mathematical and Computational Sciences may count a maximum of three semester hours of credit from Technology Labs towards their degree.

COURSE CREDIT

Unless otherwise noted in the course description below, a course in the School of Mathematical and Computational Sciences gives three semester hours of credit.

MATHEMATICS COURSES (MATH PREFIX)

101 ELEMENTS OF MATHEMATICS

This course provides an introduction to several mathematical topics at the university level, and is intended for students majoring in a discipline other than Mathematical and Computational Sciences, or

the Natural Sciences. The course consists of four modules: (1) Sets and Logic, (2) Number Theory, (3) Geometry, (4) Mathematical Systems.
PREREQUISITE: Grade XII academic Mathematics
Three lecture hours a week
NOTE: Credit will not be given jointly for this course and any other 100-level Mathematics course.

111 FINITE MATHEMATICS
This course introduces students to finite mathematical techniques and to mathematical models in business, life and the social sciences. The course begins with an introduction to mathematical models, types of models, and conversion of verbal models to mathematical models. Topics covered include systems of linear equations and matrices, linear inequalities and linear programming, sets, counting and probability.
PREREQUISITE: Grade XII academic Mathematics
Three lecture hours a week
NOTE: Credit for Mathematics 111 will not be allowed if taken concurrent with or subsequent to Mathematics 261.

112 CALCULUS FOR THE MANAGERIAL, SOCIAL AND LIFE SCIENCES
This course provides an introduction to calculus for students in the managerial, social and life sciences. The main emphasis of the course is the development of techniques of differentiation and integration of algebraic, exponential and logarithmic functions. Applications of derivatives and integrals are also discussed.
PREREQUISITE: Grade XII academic Mathematics
Three lecture hours a week
NOTE: Credit will not be given jointly for this course and Math 191

185 SPECIAL TOPICS IN CALCULUS
This course is a bridge from Math 152 to Math 291. The topics covered are those in Math 192 which were not covered in Math 152: sequences, series, tests for convergence, Taylor series and Taylor polynomials. This is a temporary course which will be offered based on demand until the transition from the Math 151,152,251,252 stream to the Math 191,192,291 stream is completed.
PREREQUISITE: Math 152
Four lecture hours per week for six weeks
Semester hours of credit: 2

191 SINGLE VARIABLE CALCULUS I
This course is an introduction to differential and integral calculus of functions of a single variable. The course is intended primarily for majors in the Mathematical and Computational Sciences, Engineering and the Physical Sciences, as well as those planning to continue with further Mathematics courses. The concepts of limits, continuity and derivatives are introduced and explored numerically, graphically and analytically. The tools of differential calculus are applied to problems in: related rates; velocity and acceleration; extrema of functions; optimization; curve sketching; and indeterminate forms. The concepts of definite and indefinite integrals are introduced, and the relation between the two integrals is discovered via the Fundamental Theorem of Calculus.
PREREQUISITE: Grade XII academic Mathematics and a passing grade on the Assessment Test.
Four lecture hours per week
Semester hours of credit: 4

192 SINGLE VARIABLE CALCULUS II

This course is a continuation of integral calculus of functions of a single variable and an introduction to sequences and series. Techniques of integration are studied, including improper integrals and numerical integration, and the tools of integral calculus are used to compute areas, volumes and arc lengths; and are applied to problems in physics and differential equations. Sequences, series, tests for convergence, Taylor series and Taylor polynomials are studied.
PREREQUISITE: Math 191
Four lecture hours per week
Semester hours of credit: 4

242 COMBINATORICS I
This course offers a survey of topics in combinatorics that are essential for students majoring in the Mathematical or Computational Sciences. Topics include: logic, proof techniques such as mathematical induction, recursion, counting methods, and introductory graph theory.
PREREQUISITE: Math 192
Three lecture hours per week

261 LINEAR ALGEBRA I
This course introduces some of the basic concepts and techniques of linear algebra to students of any major. The emphasis is on the interpretation and development of computational tools. Theory is explained mainly on the basis of two or three-dimensional models. Topics covered are: matrices; determinants; systems of equations; vectors in two and three-dimensional space including dot and cross products, lines, and planes; concepts of linear independence, basis, and dimension explained with examples; linear transformations and their matrices; eigenvectors and eigenvalues.
PREREQUISITE: Grade XII academic Mathematics
Three lecture hours per week

262 LINEAR ALGEBRA II
This course continues MATH 261 with further concepts and theory of linear algebra. Topics include real and complex vector spaces, orthogonality, Gram-Schmidt Process, canonical forms, spectral decompositions, inner product spaces and the projection theorem.
PREREQUISITE: Math 191, Math 261
Three lecture hours a week

272 MATHEMATICAL REASONING
This course provides students with experience in writing mathematical arguments. It covers first-order logic, set theory, relations, and functions. The ideas and proof techniques are considered in the context of various mathematical structures such as partial orders, graphs, number systems, and finite groups.
PREREQUISITE: None
Three lecture hours per week

281 FOUNDATIONS OF GEOMETRY
This course presents an axiomatic base for Euclidean geometry and an insight into the interdependence of the various theorems and axioms of that geometry and non-Euclidean geometries. Topics include: incidence and separation properties for points, lines, planes and space; congruence properties; geometric inequalities; similarity properties; and geometric constructions.
PREREQUISITE: Six semester hours of First Year Mathematics
Three lecture hours per week

282 MATHEMATICAL PHYSICS

See Physics 282
PREREQUISITE: Math 291 and either Physics 112 or Physics 122

291 MULTIVARIABLE AND VECTOR CALCULUS
This course continues from Math 192 and is an introduction to multivariable differentiation and integration and vector calculus. Topics include parametric representation of curves; polar coordinates; vectors; dot and cross products; curves and surfaces in space; calculus of vector-valued functions; functions of several variables; partial differentiation; directional derivatives; tangent planes; local and constrained maxima and minima; double and triple integrals; changes of variables in multiple integrals; vector fields; line and surface integrals; gradient, divergence and curl; Green's, Stokes' and Divergence Theorems.
PREREQUISITE: Math 192
Four lecture hours per week
Semester hours of credit: 4

301 DIFFERENTIAL EQUATIONS
This course introduces the basic theory of differential equations, considers various techniques for their solution, and provides elementary applications. Topics include linear equations; separable equations; linear independence and Wronskian; second-order equations with constant coefficients; nonhomogeneous equations; applications of first- and second-order equations; Laplace and inverse Laplace transforms, and their application to initial-value problems; series solutions about ordinary and singular points; and Fourier series.
PREREQUISITE: Math 192
Three lecture hours per week

331 COMPLEX VARIABLES
This is a first course in complex variables. The aim is to acquaint students with the elementary complex functions, their properties and derivatives, and with methods of integration. Topics covered include: definition and development of complex numbers as ordered pairs; geometric representation; basic formulas and inequalities involving argument and conjugates; roots of complex numbers, limit, continuity, and derivative; Cauchy Riemann conditions; harmonic functions; properties of trigonometric, hyperbolic, logarithmic, exponential, and inverse trigonometric functions; bilinear transformation; integration; Cauchy Integral Theorem and Formula; residues and poles; Laurent and Taylor's series; and improper integrals.
PREREQUISITE: Math 291
Three lecture hours per week

342 NUMBER THEORY
This first course in number theory will include the following topics: equivalence of the principles of induction and the well-ordering principle; division algorithm; positional notation and repeating decimals; greatest common divisor; Euclidean Algorithm; Fundamental Theorem of Arithmetic; Pythagorean Triplets; Prime Numbers Theorem; Mersenne and Fermat Numbers; congruences; Euler's Phi-function; Chinese Remainder Theorem; Diophantine Equations; Theorems of Lagrange and Wilson; Quadratic Reciprocity Law of Gauss; Legendre symbol and primitive roots; perfect numbers; multiplicative number-theoretic functions; Moebius inversion.
PREREQUISITE: Six semester hours of Mathematics at the 200 level or higher
Three lecture hours per week

343 COMBINATORICS II

This course continues MATH 242, with the examination of advanced counting techniques, binomial coefficients, and generating functions. Other topics include relations, partial orders, and Steiner Triple systems.
PREREQUISITE: Math 242
Three lecture hours per week

351 REAL ANALYSIS
This is a first course in real analysis. Topics include: the reals as a complete ordered field; closed and open sets; Bolzano-Weierstrass and Heine-Borel Theorems; Cauchy Sequences; limits and continuity; derivative; Mean Value Theorem; Riemann Integral; and the Fundamental Theorem of Calculus.
PREREQUISITE: Math 192 and Math 272
Three lecture hours per week

361 GROUP THEORY
An introduction to group theory, including: cyclic groups, symmetric groups, subgroups and normal subgroups, Lagrange's theorem, quotient groups and homomorphisms, isomorphism theorems, group actions, Sylow's theorem, simple groups, direct and semidirect products, fundamental theorem on finitely generated Abelian groups.
PREREQUISITE: Math 272
Three lecture hours per week

371 GRAPH THEORY
This course is an introduction to the ideas, methods, and applications of graph theory. Topics include graph connectivity, graph factors and factorizations, planar graphs, and colourings.
PREREQUISITE: Math 242 or Math 272
Three lecture hours per week

402 POINT-SET TOPOLOGY
A first course in topology, covering some review of set theory; cardinal numbers; binary relations; metric spaces, convergence and continuity in metric spaces; topological spaces, bases, sub- spaces; continuity in general; homeomorphism; product spaces; separation axioms; compactness; connectedness.
PREREQUISITE: Math 351
Three lecture hours per week

452 MEASURE THEORY AND INTEGRATION
A first course in measure theory, covering measure as a generalization of length, outer measure, sigma-algebras, measurability, construction of measures, Lebesgue measure on the real line, measurable functions and the Lebesgue integral. Additional topics may include and convergence theorems, product measures and Fubini Theorem.
PREREQUISITE: Math 351
Three lecture hours per week

453 FUNCTIONAL ANALYSIS
This first course in functional analysis covers topics like: metric spaces, Banach spaces, function spaces, Hilbert spaces, generalized Fourier series and linear operators.
PREREQUISITE: Math 262 and Math 351
Three lecture hours per week

462 RING AND FIELD THEORY
Introduction to ring and field theory, including: polynomial rings, matrix rings, ideals and homomorphisms, quotient rings, Chinese remainder theorem, Euclidean domains, principal ideal domains, unique factorization domains, introduction to module theory, basic theory of field extensions, splitting fields and algebraic closures, finite fields, introduction to Galois theory.
PREREQUISITE: Math 361
Three lecture hours per week

471 PARTIAL DIFFERENTIAL EQUATIONS
This course is an introduction to the theory and application of partial differential equations. Topics include: first-order equations and characteristic curves; classification of second-order equations as parabolic, hyperbolic or elliptic; Laplace, wave and diffusion equations, and their physical origins; solution using Fourier series; and separation of variables.
PREREQUISITE: Math 291 and Math 301
Three lecture hours per week

472 DYNAMICAL SYSTEMS
This course is a study of the long-term qualitative behaviour of solutions of systems of differential or difference equations. Topics include: non-linear systems, linearization, numerical and graphical methods, equilibria, phase space, stability, bifurcations, strange attractors, and chaos. Applications to physics, biology and other sciences are studied.
PREREQUISITE: Math 261, Math 291 and Math 301
Three lecture hours per week

STATISTICS COURSES (STAT PREFIX)

221 INTRODUCTORY STATISTICS I
The main objective of this course is to introduce the basic concepts of descriptive statistics, statistical inference, and the use of statistical software such as MINITAB to students in any discipline. More time is spent on statistical inference than on descriptive statistics. Topics include frequency distributions, descriptive statistics, rules of probability, discrete and continuous probability distributions, random sampling and sampling distributions, confidence intervals, one- and two-tail tests of hypotheses, and correlation and linear regression.
PREREQUISITE: Grade XII academic Mathematics.
Three lecture hours per week
NOTE: Credit will not be allowed for Statistics 221 if a student has received credit for any of the following courses: Business 251, Education 481, Psychology 271 and Sociology 332.

222 INTRODUCTORY STATISTICS II
The course builds upon the knowledge developed in Introductory Statistics I and introduces students to statistical techniques commonly used in research. Topics include linear regression and multiple linear regression, residual analysis, simple ANOVA models, categorical data analysis, simple sampling models, and common distributions (including binomial, Poisson, and exponential).
PREREQUISITE: Stat 221
Three lecture hours per week
321 PROBABILITY AND MATHEMATICAL STATISTICS I
This course is an introduction to the theoretical basis of statistics for students who have completed Introductory Statistics. The study concentrates on the mathematical tools required to develop statistical

methodology. Topics covered include: probability, continuous and discrete random variables, moment generating functions, multivariate probability distributions and functions of random variables.
PREREQUISITE: Math 291, and Stat 222 or permission of the instructor.
Three lecture hours per week

322 PROBABILITY AND MATHEMATICAL STATISTICS II
This course builds on the mathematical foundation developed in Mathematics 321 and introduces the student to the theory of statistical inference. Topics covered include: sampling distributions and central limit theory, methods of estimation, hypothesis testing, least squares estimation of linear models, and an introduction to Bayesian inference.
PREREQUISITE: Stat 321
Three lecture hours per week

324 APPLIED REGRESSION ANALYSIS
This course builds upon the basis of inference studied in Introductory Statistics and provides students with an advanced knowledge of regression techniques. Topics covered are simple and multiple linear regression techniques, matrix notation, the design matrix, model building techniques, residual analysis, and non-linear regression.
PREREQUISITE: Stat 222 and Math 261
Three lecture hours per week

411 STATISTICAL SIMULATION
This course introduces statistical simulation, and its use as a tool to investigate stochastic phenomena and statistical methods. Topics include the building and validation of stochastic simulation models useful in computing, operations research, engineering and science; related design and estimation problems; variance reduction; and the implementation and the analysis of the results.
PREREQUISITE: Stat 322
Three lecture hours per week

424 EXPERIMENTAL DESIGN
This course builds upon the basis of inference studied in Stat 221 and Stat 324 to include statistical techniques commonly used in experimental studies. Students will study topics such as analysis of variance models, hypothesis testing in ANOVA models, randomization, and blocking techniques.
PREREQUISITE: Stat 324
Three lecture hours per week

428 GENERALIZED LINEAR MODELS
This course covers the basic theory, methodology and applications of generalized linear models. Topics include logistic regression, probit regression, binomial regression, Poisson regression, overdispersion, quasi-likelihood, and the exponential family.
PREREQUISITE: Stat 324 and Stat 322
Three lecture hours per week

433 TIME SERIES I
An introduction to Time Series methods, including: stationary models, trends and seasonality, stochastic Time Series models, autoregressive and moving average processes and an introduction to Time Series forecasting. ARIMA models, Seasonal Time Series and Spectral Analysis are also covered.
PREREQUISITE: Stat 324

Three lecture hours per week

434 TIME SERIES II
Includes topics from Time Series Econometrics, including Maximum Likelihood and Least Squares Estimation of ARIMA Models and GARCH Models, Wavelets and Financial Models. Non-stationary Time Series, multivariate Time Series and panel cointegration analysis are also covered.
PREREQUISITE: Stat 433
Three lecture hours per week

441 STOCHASTIC PROCESSES
This is an introduction to the branch of probability theory that deals with the analysis of systems that evolve over time. Topics include random walks, Markov chains, Poisson processes, continuous time Markov chains, birth and death processes, exponential models, and applications of Markov chains.
PREREQUISITE: Stat 322
Three lecture hours per week

455 DATA ANALYSIS AND INFERENCE
Introduction to data analysis with a focus on regression. Initial examination of data. Correlation. Simple and multiple regression models using least squares. Inference for regression parameters, confidence and prediction intervals. Diagnostics and remedial measures. Interactions and dummy variables. Variable selection. Least squares estimation and inference for non-linear regression.
PREREQUISITE: Stat 324
Three lecture hours per week

466 DATA VISUALIZATION AND MINING
This course introduces students to the statistical methods involved in visualization of high dimensional data, including interactive methods directed at exploration and assessment of structure and dependencies in data. Topics include methods for finding groups in data including cluster analysis, dimension reduction methods including multi-dimensional scaling, pattern recognition, and smoothing techniques.
PREREQUISITE: Math 262, Math 291 and Stat 321
Three lecture hours per week

474 MULTIVARIATE ANALYSIS
This course deals with the statistics of observation and analysis of more than one output variable. Topics include estimation and hypothesis testing for multivariate normal data, principal component analysis and factor analysis, discriminant analysis, cluster analysis, and correspondence analysis.
PREREQUISITE: Stat 324
Three lecture hours per week

COMPUTER SCIENCE COURSES (CS PREFIX)

141 INTRODUCTION TO COMPUTER PROGRAMMING FOR SCIENTISTS
This course is an introduction to computer programming for non-computer science majors. Topics include problem-solving, algorithm design, data types, control structures, repetition, loops, nested structures, modular programming and arrays.
PREREQUISITE: Grade XII academic mathematics.
Three lecture hours and 1.5 hours of laboratory session per week.

NOTE: Credit will be allowed for only one of CS 141 or Engineering 132. As well, CS 141 may not be taken concurrently with, or after, CS 151.

151 INTRODUCTION TO COMPUTER SCIENCE I
This course is the first of a two-course sequence designed to introduce the fundamentals of Computer Science and prepare students for further studies in this or related fields. Emphasis is on problem solving and software development in a high level object-oriented language such as Java. Topics include computer fundamentals; the programming process; language syntax and semantics; simple data types, classes, methods, expressions, control structures, input/output, arrays, and graphical user interfaces.
PREREQUISITE: Grade XII academic Mathematics.
Three lecture hours and 1.5 hour of laboratory session per week
NOTE: CS 151 and Engineering 132 cannot be double credited.

152 INTRODUCTION TO COMPUTER SCIENCE II
This course continues the development of object-oriented programming topics introduced in CS 151. Topics include elementary searching and sorting, inheritance, polymorphism, recursion, exception handling, graphical user interfaces, introduction to data structures (lists, stacks, queues, trees, graphs), threads, network programming.
PREREQUISITE: CS 151
Three lecture hours and 1.5 hour of laboratory session per week

161 DIGITAL SYSTEMS
This course provides an introduction to digital systems, beginning with elementary components such as logic gates, from which are constructed components such as adders and comparators, and progressing to more complex systems such as programmable logic devices, memory and processor units. Students acquire skills in the design and analysis of combinational and sequential digital systems, CAD design and simulation tools for complex systems, and construction of digital systems based upon a modular methodology. PREREQUISITE: CS 152 or Engineering 132, three semester hours of Mathematics, or permission of the instructor (based on completion of CS 151 with first class standing)
Three lecture hours and a three-hour laboratory session per week

206 WEB DEVELOPMENT AND PROGRAMMING
In this course, students learn to create websites that involve server-side scripting and database operations. While one specific scripting language is used to acquire web development and programming skills, students are exposed to a spectrum of scripting languages, enabling them to easily adapt to others.
PREREQUISITES: CS 152
Three hours per week

212 MOBILE DEVICE DEVELOPMENT - iOS
This course introduces the student to programming for mobile devices that use iOS. The course will present a study of the architecture, operating system, and programming for these devices.
PREREQUISITE: CS 152
Three lecture hours per week

213 MOBILE DEVICE DEVELOPMENT - ANDROID
This course introduces the student to programming for mobile devices that use the Android platform. The course will present a study of the architecture, operating system and programming language of these devices.

PREREQUISITE: CS 152
Three lecture hours per week

252 COMPUTER ORGANIZATION AND ARCHITECTURE
This course provides a basic understanding of the organization and architecture of modern computer systems. It examines the function and design of major hardware components both from a designer's perspective and through assembly language programming. Topics include components and their interconnection, internal/external memory, input/output subsystems, processors, computer arithmetic, instruction sets, addressing modes, and pipelining.
PREREQUISITE: CS 152
Three hours per week

261 DATA STRUCTURES AND ALGORITHMS
This course continues the study of data structures, recursive algorithms, searching and sorting techniques, and general strategies for problem solving. It also introduces complexity analysis and complexity classes.
PREREQUISITE: CS 152 and six semester hours of Mathematics
Three lecture hours per week

262 COMPARATIVE PROGRAMMING LANGUAGES
This course examines the principal features of major types of programming languages, including procedural, logical, functional and object-oriented languages. Features include parameter-passing mechanisms, control structures, scope, and binding rules. Each language type is illustrated by considering a specific language.
PREREQUISITE: CS 261
Three lecture hours per week

271 PRACTICAL EMBEDDED SYSTEMS
This course introduces students to the concept of embedded systems architectures, the interconnection of sensors and actuators to such systems, and the usage of such platforms for data acquisition and control of automated systems. Popular microcontroller units and system-on-chip platforms will be examined.
PREREQUISITES: CS 121 or CS 141 or CS 151 or ENGN 131
Three lecture hours per week

282 PROGRAMMING PRACTICES
This course introduces the student to development in the Unix/Linux environment. Topics include development tools, shell programming, common utility programs, processes, file/directory management, IDEs, testing/debugging, version control, and an introduction to software engineering.
PREREQUISITE: CS 152 or permission of the instructor (based on completion of CS 151 with first class standing)
Three lecture hours per week

311 VIDEO GAME DESIGN
This course focuses on the process from initial idea to final design of a video game. Students will craft a game document from an original concept of their own creation and create a prototype of the game based on that document.
PREREQUISITE: CS 261
Three lecture hours per week

321 HUMAN-COMPUTER INTERFACE DESIGN
This course is an introduction to the design and evaluation of software interfaces and webpages. The course focuses on user-centered design and includes topics such as user analysis and modelling, iterative prototyping, usability testing, designing for the web, internationalization and localization.
PREREQUISITES: CS 152
Three hours per week

322 INTRODUCTION TO BIOINFORMATICS
This course is an introduction to bioinformatics, with a focus on a practical guide to the analysis of data on genes and proteins. It familiarizes students with the tools and principles of contemporary bioinformatics. Students acquire a working knowledge of a variety of publicly available data and computational tools important in bioinformatics, and a grasp of the underlying principles enabling them to evaluate and use novel techniques as they arise in the future.
Cross-listed with Biology, Pathology/Microbiology, Human Biology (cf. Biology 322, VPM 885, HB 885)
PREREQUISITE: CS 261 or BIO 223 or permission of instructor. If taken as VPM 885 or HB 885 - Admission to the graduate program and permission of the instructor.
Three lecture hours and a one-hour laboratory session per week
Note: No student can be awarded more than one course credit among HB 885, VPM 885, CS 322 and BIO 322.

342 COMPUTER COMMUNICATIONS
This course introduces the basic principles of modern computer communication: protocols, architectures and standards. Topics include layered architectures, data transmission, error and flow control, medium access, routing, congestion control and common internet application protocols.
PREREQUISITE: CS 252 and CS 282
Three lecture hours per week

352 OPERATING SYSTEMS
This course introduces the student to the major concepts of modern operating systems. Topics covered include: process management, memory management, file systems, device management and security.
PREREQUISITE: CS 252, CS 261 and CS 282
Three lecture hours per week

361 ANALYSIS AND DESIGN OF ALGORITHMS
This course, which introduces the study of algorithm design and measures of efficiency, is a continuation of CS 261. Topics include algorithm complexity and analysis; techniques such as divide and conquer, greedy and dynamic programming; searching and sorting algorithms; graph algorithms; text processing; efficient algorithms for several common computer science problems and NP-completeness.
PREREQUISITE: CS 261 and Math 242
Three lecture hours per week

362 SOFTWARE DESIGN AND ARCHITECTURE
This course examines the principles and best practices in object-oriented (OO) software design. Topics include a review of foundational OO concepts, OO design principles, classic design patterns, and software architectures.
PREREQUISITE: CS 261
Three lecture hours per week

371 DATABASE SYSTEMS
This course introduces the fundamental concepts necessary for the design, use and implementation of database systems. Topics discussed include logical and physical organization of data, database models, design theory, data definition and manipulation languages, constraints, views, and embedding database languages in general programming languages.
PREREQUISITES: CS 261
Three lecture hours per week

384 TECHNOLOGY MANAGEMENT & ENTREPRENEURSHIP
This course provides an overview on how to start and sustain a technology-oriented company. Topics discussed will include the role of technology in society, intellectual property, patents, business plans, financial planning, sources of capital, business structure, liability, tax implications, sales, marketing, operational and human resource management. This course will be taught using problem-based and experiential learning strategies with involvement from real life entrepreneurs as motivators and facilitators.
(Cross-listed with Engineering 443)
PREREQUISITE: CS 252, CS 262 and CS 282
Three lecture hours per week

406 CLOUD COMPUTING
This course examines: the critical technology trends that are enabling cloud computing, the architecture and the design of existing deployments, the services and the applications they offer, and the challenges that need to be addressed to help cloud computing to reach its full potential. The format of this course will be a mix of lectures, seminar-style discussions, and student presentations.
PREREQUISITE: CS 206
Three lecture hours per week

411 ARTIFICIAL INTELLIGENCE AND AUTOMATED REASONING
This course introduces general problem-solving methods associated with automated reasoning and simulated intelligence. Topics include problem abstraction, state space heuristic search theory, pathfinding, flocking behaviour, knowledge representation, propositional logic, reasoning with uncertainty, machine learning and connectionism.
PREREQUISITE: CS 261
Three lecture hours per week

412 MACHINE LEARNING AND DATA MINING
Machine learning is the study of mechanisms for acquiring knowledge from large data sets. This course examines techniques for detecting patterns in sets of uncategorized data. Supervised and unsupervised learning techniques are studied, with particular application to real-world data.
PREREQUISITE: CS 371 and Stat 221
Three lecture hours per week

435 COMPUTER GRAPHICS PROGRAMMING
This course introduces the student to the principles and tools of applied graphics programming including graphical systems, input and interaction, object modeling, transformations, hidden surface removal, and shading and lighting models. Languages, graphics libraries and toolkits, and video game engines are introduced, as well as relevant graphics standards.
PREREQUISITE: CS 262 and Math 261
Three lecture hours per week

436 ADVANCED COMPUTER GRAPHICS PROGRAMMING
This course builds on the computer graphics programming concepts introduced in CS 435. Students are given a deeper understanding of the components of the 3D graphics pipeline, and how they are used in modern graphical applications. Topics include advanced texture mapping, practical uses of vertex and pixel shaders, screen post-processing, particle systems, and graphics engine design.
PREREQUISITE: CS 435
Three lecture hours per week

444 DATA SCIENCE
Data science is an interdisciplinary and emerging field where techniques from several areas are used to solve problems using data. This course provides an overview and hands-on training in data science, where students will learn to combine tools and techniques from computer science, statistics, data visualization and the social sciences. The course will focus on: 1) the process of moving from data collection to product, 2) tools for preparing, manipulating and analyzing data sets (big and small), 3) statistical modelling and machine learning, and 4) real world challenges.
PREREQUISITE: CS 371 and Stat 221
Three lecture hours per week

461 WIRELESS SENSOR NETWORKS
This course is an introduction to Wireless Sensor Networks. It includes the following topics: single-node architecture, wireless sensor network architecture, physical layer, MAC protocols, link-layer protocols, naming and addressing, time synchronization, localization and positioning, topology control, routing protocols, transport layer, and quality of service.
PREREQUISITE: CS 252 and CS 261
Three lecture hours per week

465 VIDEO-GAME ARCHITECTURE
This programming-driven course aims to explore the various systems that comprise a typical video-game project, including event systems, state machines, rendering, scripting and AI programming. Students will implement these components throughout the course with the end goal of building a small game.
PREREQUISITE: CS 435
CO-REQUISITE: CS 436 (must be taken previously or concurrently)
Three lectures hours per week

472 COMPILER DESIGN
This is a first course in compiler design. The course covers: compilation phases, lexical analysis, parsing, scope rules, block structure, symbol tables, run-time heap and stack management, code generation, pre-processing, compiler-compilers, and translation systems.
PREREQUISITE: CS 332
Three lecture hours per week

481 SOFTWARE ENGINEERING
This course emphasizes the theory, methods and tools employed in developing medium to large-scale software which is usable, efficient, maintainable, and dependable. Project management is a major focus. Topics include traditional and agile process models, project costing, scheduling, team organization and management, requirements modelling/specification, software design, software verification and testing, and re-engineering.

PREREQUISITE: 4th year standing in Computer Science
Three lecture hours per week

482 SOFTWARE SYSTEMS DEVELOPMENT PROJECT
In this course, students propose, complete and present a significant software project in a group setting using the system development skills learned in CS 481. The course applies object-oriented design principles through the use of UML. Students are encouraged to select (with the consent of the instructor) a project with a real-world client.
PREREQUISITE: CS 481 (May be taken concurrently in exceptional circumstances).
One lecture hour per week plus significant project time

483 VIDEO GAME PROGRAMMING PROJECT
In this course, students work as a group to develop a single design into a fully functioning video game. This course applies the project management skills learned in CS 481 to the development of a professional quality video game based upon a single design and prototype emerging from CS 311.
PREREQUISITE: CS 311, CS 481 and enrolment in the Computer Science with Video Game Programming major.
One lecture hour per week plus significant project time.
Semester hours of credit: 6

484 PROTOTYPE SYSTEMS DEVELOPMENT
This course is for student teams who wish to develop an early prototype of a product which they hope to pitch to an external start-up accelerator program post-graduation. Student teams may be inter-disciplinary, but students must register for this course (or its equivalent) within their home school/department. Entry into the course is dependent upon a pitch for the product being judged as economically viable by a team of project mentors. Pitches are made at the conclusion of CS 384.
PREREQUISITE: CS 384 and permission of the instructor
One lecture hour per week plus significant project time.
Semester hours of credit: 6

APPLIED MATHEMATICAL SCIENCE COURSES (AMS PREFIX)

216 MATHEMATICS OF FINANCE
This first course in the mathematics of finance includes topics such as measurement of interest; annuities and perpetuities; amortization and sinking funds; rates of return; bonds and related securities; life insurance.
PREREQUISITE: Math 191
Three lecture hours a week

240 FINANCIAL MATHEMATICS & INVESTMENTS
Advanced topics of Theory of Interest as initially covered in AMS 216 including time value of money, annuities, loans, bonds, general cash flows, portfolios and immunization concepts, as well as an introduction to capital markets, analysis of equity and fixed income investments, and an introduction to derivative securities including futures, forwards, swaps and options.
PREREQUISITE: AMS 216
Three lecture hours a week

241 FINANCIAL ECONOMICS I

Introduction to mathematical techniques used to price and hedge derivative securities in modern finance. Modelling, analysis and computations for financial derivative products, including exotic options and swaps in all asset classes. Applications of derivatives in practice will also be discussed.
PREREQUISITE: AMS 240
Three lecture hours a week

251 ACTUARIAL SCIENCE I
This course will explore the future lifetime random variable, probability and survival functions, force of mortality; complete and curtate expectation of life, and Makeham and Gompertz mortality laws. Other topics will include: Life tables, characteristics of population and insurance life tables, selection, and fractional age assumptions. Life insurance payments and annuity payments: Present value random variables; expected present values; higher moments; actuarial notation, annual, 1/mthly and continuous cases, relationships between insurance and annuity functions. Premiums, expense loadings, present value of future loss random variables and distribution, net and gross cases, the equivalence principle and portfolio percentile principle will also be discussed.
PREREQUISITE: AMS 240, STAT 321
Three lecture hours a week

286 ACTUARIAL SCIENCE LAB I
This lab features problem-solving sessions for the professional examination on financial mathematics of the Society of Actuaries and the Casualty Actuarial Society.
PREREQUISITE: AMS 216
Semester hours of credit: 1

294 OPTIMIZATION
An introduction to the methods and applications of linear programming. Topics include linear programming formulations, the simplex method, duality and sensitivity analysis, and integer programming basics. Applications to transportation, resource allocation and scheduling problems will be examined. Software will be used to illustrate topics and applications.
PREREQUISITE: Math 261
Three lecture hours per week plus a two hour laboratory

316 GAME THEORY
The course covers the fundamentals of game theory and its applications to the modeling of competition and cooperation in business, economics, biology and society. It will include two-person games in strategic form and Nash equilibria, extensive form games, including multi-stage games, coalition games and the core Bayesian games, mechanism design and auctions.
PREREQUISITE: Math 192, Math 242 and Stat 222
Three lecture hours per week

331 ADVANCED CORPORATE FINANCE FOR ACTUARIES
This course covers various advanced topics in corporate finance, with emphasis on theories of corporate incentives and asymmetric information. Illustrative applications using cases are provided. Topics include: capital budgeting, real options, investment decision using Markowitz and utility theory, the Capital Asset Pricing Model, Arbitrage Pricing Theory, market efficiency and capital structure and dividend policy. Other topics may include time value of money, capital budgeting, cost of capital, security issuance, capital structure, payout policy and dividends, short-term finance, and risk management. Where suitable, topics are treated from a mathematical and quantitative perspective.
PREREQUISITE: AMS 240, BUS 231

Three lecture hours per week

341 FINANCIAL ECONOMICS II
This course will discuss advanced mathematical techniques used to price and hedge derivative securities in modern finance. Topics include: modelling, analysis and computations for financial derivative products, including exotic options and swaps in all asset classes. Students will also have the opportunity to apply these derivatives in practice.
PREREQUISITE: AMS 241
Three lecture hours per week

351 ACTUARIAL SCIENCE II
This course will discuss: policy values, annual, 1/mthly and continuous cases, Thiele's equation, policy alterations, modified policies and multiple state models. Other topics will include applications in life contingencies, assumptions, Kolmogorov equations, premiums, policy values, multiple decrement models, Joint Life Models, Valuation of insurance benefits on joint lives, and dependent and independent cases.
PREREQUISITE: AMS 251, Stat 322
Three lecture hours per week

373 ADVANCED INSURANCE AND ACTUARIAL PRACTICES
This course is a study of cash flow projection methods for pricing, reserving and profit testing. Topics include: deterministic, stochastic and stress testing; pricing and risk management of embedded options in insurance products; mortality and maturity guarantees for equity-linked life insurance.
PREREQUISITE: AMS 351
Three lecture hours per week

377 COMBINATORIAL OPTIMIZATION
In this course, various algorithms will be considered, including minimum spanning tree, shortest path, maximum flow, and maximum matching. The links with linear and integer programming will also be considered, with particular attention to duality.
PREREQUISITES: Math 242, AMS
294. Three lecture hours per week

391 MATHEMATICAL MODELLING
This course studies the process of mathematical modeling, namely, formulating a “real-world” problem in mathematical terms, solving the resulting mathematical problem, and interpreting the solution. Major topics include the modeling of optimization problems (using the techniques of linear programming), and deterministic and probabilistic dynamical processes (with models formulated as differential and difference equations). Applications are taken from science, business and other areas, according to class interest.
PREREQUISITE: Math 261 and Math 301; a statistics course is recommended.
Three lecture hours per week

408 FINANCIAL MATHEMATICS II
This course explores calculus in stochastic environment. Topics include: random functions, derivative, chain rule, integral, integration by parts, partial derivatives, pricing forwards and options. Ito’s lemma and financial applications, Hull-White, Artzner-Heath, and Brennan-Schwartz models, Martingales, pricing methodology, and risk-neutral probability will also be discussed.

PREREQUISITE: Math 261 and AMS
341. Three lecture hours per week

409 FINANCIAL MATHEMATICS III
This course discussed forming risk-free portfolios: the Black-Scholes partial differential equation, constant dividend case, exotic options, drift adjustment, and equivalent martingale measures. Topics also include: Cox-Ross-Rubinstein, Merton and Vasicek's models, stochastic optimization, Hamilton-Jacobi-Bellman equation, and application to American options.
PREREQUISITE: AMS 408 and Stat
322. Three lecture hours per week

454 LOSS MODELS I
This course explores models for loss severity: parametric models, effect of policy modifications, tail behaviour. Topics also include: models for loss frequency: (a, b, 0), (a, b, 1), mixed Poisson models; compound Poisson models, Aggregate claims models: moments and moment generating function: recursion and Classical ruin theory.
PREREQUISITE: AMS 351, Stat 322
Three lecture hours per week

455 LOSS MODELS II
This course is a study of the mathematics of survival models and includes some examples of parametric survival models. Topics include: tabular survival models, estimates from complete and incomplete data samples, parametric survival models, and determining the optimal parameters. Maximum likelihood estimators, derivation and properties, product limit estimators, Kaplan-Meier and Nelson-Aalen, credibility theory: limited fluctuation; Bayesian; Buhlmann; Buhlmann-Straub; empirical Bayes parameter estimation; statistical inference for loss models; maximum likelihood estimation; the effect of policy modifications; and model selection will also be discussed.
PREREQUISITE: AMS 454
Three lecture hours per week

458 CREDIBILITY THEORY
This course is a credibility approach to inference for heterogeneous data; classical, regression and Bayesian models; with illustrations from insurance data.
PREREQUISITE: AMS 351 and Stat 322
Three lecture hours per week

468 NONLINEAR OPTIMIZATION
This course is a study of unconstrained optimization, optimality conditions (necessary, sufficient and Karush-Kuhn-Tucker), penalty functions, convex functions, and convex programming.
PREREQUISITE: Math 291 and AMS 294
Three lecture hours per week

478 QUANTITATIVE RISK MANAGEMENT
This course in an introduction to financial risk management. Topics include: risk measures, modelling for multivariate distributions and copulas, market, credit and operational risk. Advanced topics in quantitative risk management will also be discussed.
PREREQUISITE: AMS 331
Three lecture hours per week

MATHEMATICAL AND COMPUTATIONAL SCIENCES COURSES (MCS PREFIX)

201 MAPLE TECHNOLOGY LAB
An introduction to the software package MAPLE. Topics include the basic functions and commands, programming and problem-solving using MAPLE.
PREREQUISITE: CS 151, Math 192
Two lab hours per week for 6 weeks
Semester hours of credit: 1

202 MATLAB TECHNOLOGY LAB
An introduction to the software package Matlab. Topics include the basic functions and commands, programming and problem-solving using Matlab. Two lab hours per week for 6 weeks.
PREREQUISITE: CS 151, Math 261
Semester hours of credit: 1

203 R TECHNOLOGY LAB
An introduction to the software package R. Topics include the basic functions and commands, programming and problem-solving using R. Two lab hours per week for 6 weeks.
PREREQUISITE: CS 151, Stat 222
Semester hours of credit: 1

204 VISUAL BASIC IN EXCEL TECHNOLOGY LAB
An introduction to the software package Excel and Visual Basic in the Excel environment. Topics include the basic functions and commands, programming and problem-solving using Excel and Visual Basic. Two lab hours per week for 6 weeks.
PREREQUISITE: CS 151, AMS 240
Two lab hours per week for 6 weeks
Semester hours of credit: 1

205 GGY AXIS TECHNOLOGY LAB
An introduction to the software package GGY AXIS. Topics include the basic functions and commands, programming and problem-solving using GGY AXIS. Two lab hours per week for 6 weeks.
PREREQUISITE: CS 151, AMS 251
Two lab hours per week for 6 weeks
Semester hours of credit: 1

284 CO-OP CAREER SKILLS I
This course offers introductory career skills training to prepare co-op students for their first work term. Students are assessed on a pass/fail basis.
Cross-listed with Business (cf. Business 292)
PREREQUISITE: Acceptance into the Mathematical and Computational Sciences Co-operative Education Program.
Semester hours of credit: 0

285 CO-OP WORK TERM I
This course is a co-op student's first work term. A work term report related to a technical problem/issue within the organization where the student is working is required. Students are assessed on a pass/fail basis.

PREREQUISITE: MCS 284 or permission of the Academic Director of Co-operative Education.
Three semester hours of credit

305 TUTORING IN MATHEMATICAL AND COMPUTATIONAL SCIENCES
Students are introduced to techniques for facilitating learning in the Mathematical and Computational Sciences, and then put these techniques into practice by mediating student group learning either in introductory Mathematical and Computational Sciences courses, Mathematical and Computational Science Help Centre or in outreach programs to High Schools. Students are assessed on a pass/fail basis.
PREREQUISITE: At least 36 semester hours of credit completed in courses in the School of Mathematical and Computational Sciences
One lecture hour per week plus practical tutoring
Semester hours of credit: 1

332 THEORY OF COMPUTING
This course introduces automata theory, formal languages and computability. Topics include: finite automata; regular expressions; regular, context-free, and context-sensitive languages; computability models; algorithmic decidable and undecidable problems.
PREREQUISITE: CS 261 and Math 242
Three lecture hours per week

350 QUANTUM INFORMATION
Introduction to quantum information science; the field of studying, storing, processing and communicating information using quantum systems. Topic includes quantum mechanics for Qubit Systems, foundations of Quantum Computing, algorithms, communication and cryptography.
PREREQUISITE: Math 262
Three lecture hours per week.

384 CO-OP CAREER SKILLS II
This course offers career skills training to strengthen co-op students' readiness for their second work term. Students are assessed on a pass/fail basis.
Cross-listed with Business (cf. Business 392)
PREREQUISITE: MCS 285
Semester hours of credit: 0

385 CO-OP WORK TERM II
This course is a co-op students' second work term. Students will submit a report summarizing their work term achievements. Students are assessed on a pass/fail basis.
PREREQUISITE: MCS 384 or permission of the Academic Director of Co-operative Education.
Three semester hours of credit

392 NUMERICAL ANALYSIS
Approximate solution of equations, various interpolative or iterative methods, especially Newton's; convergence tests and rates of convergence; roundoff and truncation errors; propagation of error in calculations; interpolating polynomials; Gauss-Jordan and other methods for simultaneous linear equations; inversion of matrices; determinants and eigenvalues; simultaneous nonlinear equations; evaluation of definite integrals; approximate derivatives; initial-value ordinary differential equations; least-squares curve fitting.
PREREQUISITE: Math 301 and CS 151 or equivalent
Three lecture hours per week

395 SPECIAL TOPICS IN MATHEMATICAL AND COMPUTATIONAL SCIENCES
This course provides students with an opportunity to pursue special topics in Mathematical and Computational Science. Content varies from year to year. Prospective students should contact the School of Mathematical and Computational Sciences for a more detailed description of any particular year's offering.
PREREQUISITE: Permission of the instructor
Three lecture hours per week and (possibly) one tutorial session per week

421 PROFESSIONAL COMMUNICATION AND PRACTICE
This course aims to build students' oral and written communications skills, and to prepare students to think critically about essential and potentially controversial issues in the Mathematical and Computational Sciences, with the goal of preparing students for a professional environment. Using examples from their discipline, students will focus on such aspects as description of processes, presentation of data, extended abstracts, correct use of terminology, and sensitivity to language and tone. Discussions of topics relevant to the professional Mathematical and Computational Scientist, such as: ethics; security; privacy and civil liberties; risk and liability; intellectual property; and certification standards are also a key part of the course.
PREREQUISITE: At least 36 semester hours of credit completed in courses in the School of Mathematical and Computational Sciences
Three hours per week

442 CRYPTOGRAPHY AND CODES
Topics include classic and modern methods of encryption, applications to public-key ciphers, random number generators, attacks on encryption systems, error correcting codes; computational number theory.

PREREQUISITE: Math 342
Three lecture hours per week

484 CO-OP CAREER SKILLS III
This course offers career skills training to strengthen co-op students' readiness for their third work term. Students are assessed on a pass/fail basis.
Cross-listed with Business (cf. Business 492)
PREREQUISITE: MCS 385
Semester hours of credit: 0

485 CO-OP WORK TERM III
This course is a co-op students' third work term. Students will submit a report summarizing their work term achievements. Students are assessed on a pass/fail basis.
PREREQUISITE: MCS 384 or permission of the Academic Director of Co-operative Education.
Three semester hours of credit

490 HONOURS PROJECT
This course is intended to give research experience to students planning to pursue graduate studies in an area of Mathematical and Computational Sciences, or planning a career where research experience would be an asset. It provides students with the opportunity to do an independent research project on Mathematical or Computational Sciences topic, under the supervision of a faculty member. Some or all of the work may be done during the summer months.

PREREQUISITE: Acceptance to an Honours program in the School of Mathematical and Computational Sciences (see Calendar listing for entrance requirements)
Semester hours of credit: 6

491 DIRECTED STUDIES IN MATHEMATICAL AND COMPUTATIONAL SCIENCES
These courses are designed and recommended for students in the Mathematical and Computational Sciences to encourage independent initiative and study. Reading and research will be conducted in one or more specialized areas.
(See Academic Regulation 9 for Regulations Governing Directed Studies.)
PREREQUISITE: Permission of the instructor

495 ADVANCED TOPICS IN MATHEMATICAL AND COMPUTATIONAL SCIENCES
This course provides students with an opportunity to pursue advanced topics in the Mathematical and Computational Sciences Content varies from year to year but is always at a fourth-year level. Prospective students should contact the School of Mathematical and Computational Sciences for a more detailed description of any particular year's offering.
PREREQUISITE: Permission of the instructor
Three lecture hours per week

585 CO-OP WORK TERM IV
This optional work term is only available to co-op students in the School of Mathematical and Computational Sciences, who elect for a fourth work term. The goal is to add further value for the student, integrating classroom theory with professional skills acquired during the work term. Students are assessed on a pass/fail basis.
PREREQUISITE: MCS 485
Semester hours of credit: 0
CARRIED

Veterinary Medicine

OMNIBUS Motion (C. Lacroix/G. Keefe) that motions 89-91 as noted below be approved:

89) That the course title and description for VCA 811 be revised as proposed.

VCA 811 - ADVANCED MEDICINE OF ~~THE RENAL, GENITOURINARY AND~~ URINARY, ENDOCRINE AND METABOLIC/ELECTROLYTE DISORDERS
This course is a detailed study of the physiology, pathophysiology, diagnosis, and management of ~~disorders of the renal and urinary systems~~ urinary, endocrine and metabolic/electrolyte disorders of companion animals. Areas of current interest or controversy, as well as recent advances in knowledge and management ~~in the field,~~ are emphasized. Requirements for the course include critical evaluation of current literature and presentation of ~~an informal~~ seminars on ~~a specific~~ selected topics.
PREREQUISITE: Undergraduate courses in physiology, pathophysiology and medicine and permission of the instructor.
HOURS OF CREDIT: 2
LECTURES: 2 hours
CARRIED

90) That the course title and description for VCA 821 be revised as proposed.

VCA 821 - ADVANCED MEDICINE OF ~~THE IMMUNOLOGIC, PULMONARY, AND NEUROMUSCULAR SYSTEMS~~ RESPIRATORY AND CARDIOVASCULAR DISORDERS AND CRITICAL CARE

This course is a detailed study of the physiology, pathophysiology, diagnosis, and management ~~of disorders of the immunologic, pulmonary, and neuromuscular systems of~~ of respiratory and cardiovascular disorders of companion animals. Issues in critical care medicine are included. Areas of current interest or controversy, as well as recent advances in knowledge and management ~~in the field, will be~~ are emphasized. Requirements for the course ~~may~~ include critical evaluation of current literature and presentation of ~~an Informal~~ seminars on selected topics.

PREREQUISITE: Undergraduate courses in physiology, pathophysiology and medicine and permission of the instructor.

HOURS OF CREDIT: 2

LECTURES: 2 hours

CARRIED

91) That the course title and description for VCA 831 be revised as proposed.

VCA 831- ADVANCED MEDICINE OF GASTROINTESTINAL, ~~HEMOLYMPHATIC , AND CARDIOVASCULAR SYSTEMS~~ HEPATOBILIARY PANCREATIC AND INFECTIOUS DISORDERS AND NUTRITION

This course is a detailed study of the physiology, pathophysiology, diagnosis, and management of ~~disorders of the~~ gastrointestinal, ~~hemolymphatic, and cardiovascular systems~~ hepatobiliary, pancreatic and infectious disorders of companion animals. Issues in nutritional management of disease are included. Areas of current interest or controversy, as well as recent advances in knowledge and management ~~in the field~~ are emphasized. Requirements for the course ~~will~~ include critical evaluation of current literature and presentation of ~~an informal~~ seminars on selected topics.

PREREQUISITE: Undergraduate courses in physiology, pathophysiology and medicine and permission of the instructor.

HOURS OF CREDIT: 2

LECTURES: 2 hours

CARRIED

6. Annual Reports

Senate Committee on Enhancement of Teaching (For Information)

Senators thanked the Committee for the activities report and asked for clarification around ideas for themes to be undertaken in the future, particularly with regard to the following statement: **indigenizing the curriculum/decolonizing the university**. A. Braithwaite, Chair of the SCENT Committee, provided clarification around the wording and agreed to add a sentence to the report to explain what was intended with the statement.

Senate Library Committee (For Information)

A Senator asked for clarification on the HST tax amount referenced in the report. D. Moses will review and bring clarification back to the Senate.

One Senator indicated there has been some difficulty in accessing books from compact storage recently and wondered why. D. Moses stated that there was a humidity issue in the Library in August of last year causing some access issues. It is hoped the issue will be resolved soon.

7. Academic Plan Update

C. Lacroix provided an update and stated that while 35 initiatives were mapped out in the Plan, not all will be started at the same time. The following have been identified as the first to commence review – Initiatives #17, #19, #22, #23, #26 and #32. The plan is to use the existing Senate committees for the initiatives that fall under specific Senate committee mandates. C. Lacroix thanked Dave Cormier for his work on this project. He also stated that if Senate members are interested in working on any specific initiative, they should contact R. Gilmour.

C. Lacroix reported that the Project Management Template can be shared with committees. The website is up outlining the Academic Plan and it will be updated as the initiatives are approved by Senate.

8. Other Business

J. Rix, Student Union Representative, requested that the following matters be addressed as they are of concern to students:

i) timely feedback for students as to how they are doing in courses, before the drop dates;
ii) regulation on how on-line courses should be governed and how exam/test standards are set; and,
iii) request for an Academic Regulation to codify the syllabus as the agreement between the faculty and students, and clarification as to what occurs when storm days cause an interruption in the predefined delivery of a course, particularly regarding marking.

Some discussion ensued around the topics and it was agreed that these issues be brought to APCC for discussion and recommendation, so the following motion was proposed:

Motion (J. Rix/O. Shaw) that the Student Union will forward the above-mentioned topics as agenda items at a future APCC meeting. CARRIED

9. Adjournment

MOTION (O. Shaw/L. Edwards) moved the meeting be adjourned at 4:55 p.m.

Respectfully Submitted

Kathleen Kielly
Secretary of Senate