Why do I have to fill out this syllabus?

The Queen's University Senate approved a motion by AMS in 2009 that all courses send in a syllabus to the AMS to be part of a central syllabus bank. This motion was brought forth before the Senate again in 2014, and programs are expected to comply with this request.

The Faculty of Engineering has also realized the need of providing engineering departments with support in curriculum development, accreditation and cyclical program review. There is a great deal of information required for these reports, most of which is contained within the syllabi and faculty course lists.

In order to meet all of the above needs, as well as being sensitive to the workload of instructors; we have created an **FEAS sample syllabus** based on pedagogical best practices and student needs. This provides both a template for a syllabus as well as a completed sample to work from.

What is this syllabus is used for:

First and foremost, this syllabus provides students with critical course information and timeline details that are essential for student success.

In addition, this template collects information about courses to:

- Generate Course Information Sheets for Accreditation
- Generate Curriculum Information for Cyclical Program Review
- Generate Curriculum Mapping for program use
- Generate Course and Program Reports for program and instructor use
- Provide programs with information to improve program quality
- Provide programs a means to illustrate student development through the program.

Instructions

1. Fill out the template as completely as possible. Replace all elements with those specific to your course.
    - Pages 1,2,5,6 and the Timetable **MUST** be completed
    - All other elements are optional but strongly recommended.
2. Once complete remove these instructions.
3. Email the completed file to your program representative.

Faculty of Engineering and Applied Science

APSC XXX Insert Course Title (Example)

Course Outline – Fall 2015

This is your course syllabus. Keep it for future reference.

Instructor Information

Paul Hungler, PhD, PEng Sawyer Bldg Rm 4410 Royal Military College of Canada 613-541-6000 x6353 *paul.hungler@queensu.ca* **Office Hours:** Tues 3-5pm EST	
Peter Gallant, Ph.D. Adjunct Instructor, Queen's School of Business Mobile: (343) 363-6590 *gallantp@queensu.ca* **Office Hours:** Wed 2-4pm EST	

Teaching Assistant Information

Teaching Assistants (TAs) contact information can be found on the class website.

Calendar description

This course will provide the student in the Engineering program with the ability to appropriately incorporate selected economic and business practices into the practice of engineering. The practices covered include: business planning for the enterprise, enterprise economic analysis, project management process, project economic analysis, risk analysis and management, quality management and change management. Assignments and examples are based on situations from engineering based industries.

Prerequisites: none

Indicators and Outcomes

Graduate attribute indicators

APSC XXX develops the Canadian Engineering Accreditation Board Graduate Attributes through four indicators:

- APSC-2-EC-1: Gathers appropriate information, categorize it, and determines the economic attractiveness of an engineering project [introductory]
- APSC-2-EC-2: Measures and manages the risks associated with the engineering project and considers the risk and return relationship as a component of determining economic attractiveness [intermediate]
- APSC-2-EC-4: Describes a project's sustainability and broader contribution and impact on the enterprise, environment and society [advanced]
- APSC-2-EC-5: Demonstrates use of change management principles [introductory]

Course Learning Outcomes (CLO)

By the end of this course, learners should be able to:

- CLO 1: Solve problems involving cash flows and economic return (time value of money and project comparison methods)
- CLO 2: Determine the economic attractiveness of an engineering project (replacement analysis, inflation, taxes, sensitivity, assessing risk, estimating costs) *[APSC-2-EC-1], [APSC-2-EC-2]*
- CLO 3: Conduct opportunity analysis to determine economic feasibility of an innovation
- CLO 4: Identify opportunities for employment/intrapeneurship/entrepreneurship *[APSC-2-EC-5]*
- CLO 5: Apply Entrepreneurial Business Design Frameworks *[APSC-2-EC-4]*

Prerequisite knowledge

This course is designed for learners with no economics background; however, they will need to be comfortable with the foundations of algebra and with Excel.

Course length and pace

This course represents a study period of one semester. The course material is divided into two tracks over a total of 12 weeks. Learners can expect to invest on average 7-9 hours per week in this course. At the end of this document is a Timetable and more detail is found on the class website.

Learners who adhere to a pre-determined study schedule are more likely to successfully complete the course on time.

Academic integrity

Engineers have a duty to:

- Act at all times with devotion to the high ideals of personal honour and professional integrity
- Give proper credit for engineering work

> *-Professional Engineers Ontario Code of Ethics, Section 77 of the O. Reg. 941*
> *http://peo.on.ca/index.php?ci_id=1815&la_id=1*

The quote above describes the standard of behaviour expected of professional engineers. As engineering students, you have made a decision to join us in the profession of engineering, a long-respected profession with high standards of behaviour.

As future engineers, we expect you to behave with integrity at all times. Our policies do not prohibit you from collaborating, even closely, with fellow learners in any class. Indeed, we strongly encourage collaboration and teamwork, when conducted responsibly. We have however, set firm guidelines on the quality of submitted work and have taken a strong stand against plagiarism and other forms of academic dishonesty. Briefly stated, we expect that submitted work bears the name of all those contributing to it, and that you do not allow others to copy your work.

Should a student's submitted work be suspected of containing evidence of academic dishonesty, action shall be taken, as required by the Faculty of Applied Science policy on academic integrity: *http://appsci.queensu.ca/policy/Honesty.html*

Additional information on the University's policies concerning academic dishonesty can be found on the Queen's website. **All learners are expected to familiarize themselves with these policies** and to conduct themselves accordingly.

- *Senate Academic Integrity Policy Statement*
- *Procedures for dealing with departures from academic integrity in the Faculty of Engineering and Applied Science*
- *Queen's University Code of Conduct*

Expectations for interaction

There will be opportunities to interact with your instructor(s), TA(s) and fellow classmates throughout this course. As highlighted above, we expect you to behave with integrity at all times. If you have a confidential mater that you would like to discuss with an instructor, their email addresses and telephone numbers at the top of this document. Expect email replies within 48 hours and in some cases within 24 hours. Instructors and TAs will be providing feedback to learners on graded activities. Expect feedback within 7 days of the due date.

Course-specific policies

In keeping with the Faculty of Engineering and Applied Science *Faculty Regulation 5b*, "A student who claims illness or compassionate grounds as a reason for missing any required component of the course other than the final exam is responsible for making alternative arrangements with the instructors concerned." Note that unacceptable reasons include: malfunctioning computer, travel plans to go home for holidays, generally behind on schoolwork, etc. The instructor may request some substantiating documentation. If alternate arrangements are not agreed upon, then the normal late penalty will apply as described in the assignment.

Individual needs and support

Learners with diverse learning styles and needs are welcome at Queen's. In particular, if you have a disability or health consideration that may require accommodations, please feel free to approach the instructor and/or Accessibility Services as soon as possible. The Accessibility Services staff is available by appointment to develop individualized accommodation plans, provide referrals and assist with advocacy. The sooner you let us know your needs, the better we can assist you in achieving your learning goals at Queen's. For further information, visit the *Student Wellness Services* website. The class website is powered by the Brightspace by D2L Learning Environment that *complies with common accessibility standards* and every effort has been made to provide course materials that are accessible. If you find any element of this course difficult to access, please discuss with your instructor how you can obtain an accommodation.

Academic and student support

Queen's has a robust set of supports available to you including the *Library*, *Student Academic Success Services (Learning Strategies and Writing Centre)*, and *Career Services*. Learners are encouraged to visit the Faculty of Engineering and Applied Science *Current Students* web portal for information about various other policies such as academic advisors, registration, student exchanges, awards and scholarships, etc.

Technical skills and support

No specialized computer-related technical skills are required for this course. If you require any technical assistance, please contact *Technical Support*.

Evaluation

Activity	Due Date (before midnight EST, unless otherwise specified)	Weight	Alignment with UDLEs[1]	Alignment with CLOs
Quizzes (6)	Sundays of weeks 1, 3, 5, 7, 9 and 11	6 @ 2.5%/each = 15% total	UDLEs 1,3	CLO 1,2,3,4
Team Project (3 phases)	Sunday of weeks 4, 8, 12	3 @ 15%/each = 45% total	ALL UDLEs	ALL CLOs
Final Exam (Proctored)	During the exam period	40%[2]	UDLEs 1,2,3,4,5	CLO 1,2,3,4
	Total	100%		

Quizzes

The Quizzes are taken on the class website and they can involve questions that are a mixture of calculation, short answer and multiple choice. You have a 7-day window of opportunity to initiate a quiz. The quizzes for each week will close at 11:59 PM on Sunday of each week. Once you initiate a quiz you have 1 hour to complete it.

Team Project

More information about the Team Project can be found on the class website.

Final Examination

The date, time and location of the Final Examination will be announced through SOLUS. The Final Exam is closed book; however, a formula sheet will be provided.

Course materials

Required textbook

- Engineering Economics, Second Custom Edition for Queen's University ISBN-13: 9781256865728
- Entrepreneurship: Successfully Launching New Ventures (Barringer and Ireland), 4th Edition (Chapters 2, 3, 6 and 8). Custom Package, ISBN-13: 9781269813815

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[1] As per "Guidelines for University Undergraduate Degree Level Expectations," December 16, 2005. http://www.queensu.ca/ctl/resources/topicspecific/quqaps/expectations.html

[2] There is no requirement to pass the final exam to pass the course.

If you have not already purchased the textbook and additional chapters on Business and Entrepreneurship required for this course, go to *www.campusbookstore.com* and follow the "Textbook Search Engine" link. Note that three copies of the custom textbook have been placed on reserve in the Stauffer Library on Queen's campus.

Required calculator

- A Casio 991 OR a comparable calculator. **ONLY** this type of non-programmable, non-communicating calculator will be allowed during tests and exams.

Other material

All other course material is accessible via the class website. Once you have completed reading this Course Outline in detail, explore the **Content** link on the class website to find the module-specific material.

Timetable

Week	Learning Outcomes (with alignment to CLOs shown in square brackets)	Deliverable (with alignment to CLOs shown in square brackets)
1	**Module 1: Overview of automation and robotics in mining** After completing this module, learners will be able to: • Explain the basics of surface and underground mining as well as the fundamental stages of modern mining [CLO1] • Compile a list of technology drivers in mining [CLO1] • State the current role of automation and robotics in mining [CLO1]	**Lab 1 [CLO 1-5]**
2	**Module 2: Modelling of mechanical systems: Part 1** After completing this module, learners will be able to: • Classify common mining machines by their type (manipulator versus mobile) and describe the difference between these types [CLO1, CLO2] • Apply kinematic modelling techniques to manipulator-type machines in mining [CLO2] • Apply kinematic modelling techniques to mobile-type machines in mining [CLO2] Formulate system models in state space representation [CLO2]	
3	**Module 2: Modelling of mechanical systems:Part 2**	**Lab 2 [CLO 1-5]**

Week	Learning Outcomes (with alignment to CLOs shown in square brackets)	Deliverable (with alignment to CLOs shown in square brackets)
	After completing this module, learners will be able to: • Classify common mining machines by their type (manipulator versus mobile) and describe the difference between these types [CLO1, CLO2] • Apply kinematic modelling techniques to manipulator-type machines in mining [CLO2] • Apply kinematic modelling techniques to mobile-type machines in mining [CLO2] • Formulate system models in state space representation [CLO2]	
4	**Module 3: Fundamentals of systems and control with examples Part 1** After completing this module, learners will be able to: • Illustrate by way of block diagrams generalized architectures for a robotic systems, including machine (model), sensors, and feedback control [CLO2, CLO3] • Apply linear full-state feedback control techniques to create asymptotically stable closed-loop robotic systems [CLO2] • Compute linearizations of nonlinear systems about an equilibrium point [CLO2]	**Team Project Phase 1 [CLO 1-5]**
5	**Module 3: Fundamentals of systems and control with examples Part 2** After completing this module, learners will be able to: • Illustrate by way of block diagrams generalized architectures for a robotic systems, including machine (model), sensors, and feedback control [CLO2, CLO3] • Apply linear full-state feedback control techniques to create asymptotically stable closed-loop robotic systems [CLO2] Compute linearizations of nonlinear systems about an equilibrium point [CLO2]	
6	**Module 4: Application of feedback control to mobile equipment Part 1** After completing this module, learners will be able to: • Formulate a model for the error dynamics associated	**Lab 3 [CLO 1-5]**

Week	Learning Outcomes (with alignment to CLOs shown in square brackets)	Deliverable (with alignment to CLOs shown in square brackets)
	with a control problem [CLO2] • Apply linearization techniques to design a feedback control system that makes a multi-wheeled vehicle track a trajectory [CLO2]	
7	**Module 4: Application of feedback control to mobile equipment Part 2** After completing this module, learners will be able to: • Formulate a model for the error dynamics associated with a control problem [CLO2] Apply linearization techniques to design a feedback control system that makes a multi-wheeled vehicle track a trajectory [CLO2]	**Quiz 1 [CLO 1,2,3,4]**
8	**Module 5: Sensors and perception** After completing this module, learners will be able to: • Classify different types of sensors (e.g., exteroceptive or proprioceptive, passive or active) and cite their advantages/disadvantages [CLO3] • Choose sensors that are appropriate for example applications in mining [CLO3]	**Team Project Phase 2 [CLO 1-5]**
9	**Module 6: State estimation and system design examples Part 1** After completing this module, learners will be able to: • Apply Kalman filter (KF) algorithms to design state estimation solutions for linear robot models [CLO4] • Apply extended Kalman filter (KF) algorithms to design state estimation solutions for wheeled mining vehicle [CLO4] • Combine control and estimation techniques to create a closed-loop feedback control and estimation solutions for a wheeled mining vehicle [CLO3, CLO4, CLO5] • Recognize the assumptions and limitations associated with these techniques [CLO5]	**Quiz 2 [CLO 1,2,3,4]** **Lab 4 [CLO 1-5]**

Week	Learning Outcomes (with alignment to CLOs shown in square brackets)	Deliverable (with alignment to CLOs shown in square brackets)
10	**Module 6: State estimation and system design examples Part 2** After completing this module, learners will be able to: • Apply Kalman filter (KF) algorithms to design state estimation solutions for linear robot models [CLO4] • Apply extended Kalman filter (KF) algorithms to design state estimation solutions for wheeled mining vehicle [CLO4] • Combine control and estimation techniques to create a closed-loop feedback control and estimation solutions for a wheeled mining vehicle [CLO3, CLO4, CLO5] Recognize the assumptions and limitations associated with these techniques [CLO5]	
11	**Module 6: State estimation and system design examples Part 3** After completing this module, learners will be able to: • Apply Kalman filter (KF) algorithms to design state estimation solutions for linear robot models [CLO4] • Apply extended Kalman filter (KF) algorithms to design state estimation solutions for wheeled mining vehicle [CLO4] • Combine control and estimation techniques to create a closed-loop feedback control and estimation solutions for a wheeled mining vehicle [CLO3, CLO4, CLO5] Recognize the assumptions and limitations associated with these techniques [CLO5]	

Week	Learning Outcomes (with alignment to CLOs shown in square brackets)	Deliverable (with alignment to CLOs shown in square brackets)
12	**Module 6: State estimation and system design examples Part 4** After completing this module, learners will be able to: • Apply Kalman filter (KF) algorithms to design state estimation solutions for linear robot models [CLO4] • Apply extended Kalman filter (KF) algorithms to design state estimation solutions for wheeled mining vehicle [CLO4] • Combine control and estimation techniques to create a closed-loop feedback control and estimation solutions for a wheeled mining vehicle [CLO3, CLO4, CLO5] Recognize the assumptions and limitations associated with these techniques [CLO5]	**Lab 5 [CLO 1-5]** **Quiz 3 [CLO 1,2,3,4]** **Team Project Phase 3 [CLO 1-5]**

General feedback

Your input is essential for maintaining and improving the quality of this course material for future offerings, e.g., course content, typos, assignments, readings, course design. Email your comments to any instructor. Your input will also be solicited in course evaluation surveys.

Important information

Your instructors are your first point of contact. Their contact information can be found at the top of this document. If you have questions about this course during the semester, contact your instructors. Please use email as the primary means of content, **and be sure to allow 24 hours for a response.**