M E M O

TO: Timothy Weber

FROM: B. Hellinga, Associate Dean, Graduate Studies
Faculty of Engineering

RE: Engineering Faculty Council Agenda

DATE: May 4, 2017

Please place the following motions forward for approval at the next meeting of EFC. These motions were approved by EGSC on April 12, 2017:

1. The Department of Management Sciences is requesting approval for the following motion:

   **Description of Proposed Changes**

   a) Change course requirements for MMSc students – **Rationale for MMSc changes:**
   minor changes to course requirements and removing previous course exemptions.

   b) Change program requirements for MASc students

   c) Change the program requirements for PhD students – **Rationale for MASc and PhD changes:**
   the programs will be more research focused. The required core courses include advanced courses in all three research areas in Management Sciences.

   d) Course changes
      1. Add new courses MSCI 623 (previously MSCI 723)
      2. MSCI 630 (previously MSCI 730)
      3. MSCI 634 (replacing MSCI 760-topic 32)
      4. MSCI 641 (new course)
      5. Revise MSCI 603 by adding anti-requisite MSCI 634
      6. Inactivate MSCI 723
      7. Inactivate MSCI 730

   **Rationale for Proposed Changes**
   Changing numbering system from 700 to 600 level to be consistent with core course numbering in department, replacing a course, adding a new course
2. The **Collaborative Water Program** is requesting approval for the following motion:

**Description of Proposed Changes**

a) Add a research seminar milestone requirement for all CWP students – **Rationale for proposed change**: The program committee has agreed that a new academic contribution milestone should be included as a program requirement.

b) Add new program requirements for PhD Water students – **Rationale for proposed change**: The program committee has agreed that a new research seminar milestone and academic contribution milestone should be included as a program requirement for PhD Water students who have completed a Masters Water degree at Waterloo.

c) Revise WATER 601 and WATER 602 course descriptions – **Rationale for proposed change**: The proposed changes reflect the current pedagogy and content of these courses

3. The **Department of Electrical and Computer Engineering** would like to request approval for the following motion:

**Description of Proposed Changes**

a) Add ECE 642 to Circuits and Systems, Silicon Devices and Integrated Circuits, and VLSI’s core course lists – **Rationale for proposed change**: new course, not previously offered.

b) Add NE 479-T1 and NE 472 as anti-requisite for ECE 634 – **Rationale for proposed change**: Course formally called ECE 730-T18 – NE 479-T1 and NE 472 were anti-reqs and held withs which never got carried over in the course renumbering.

c) Remove MSCI 638, 646 and 632 from ECE’s MEng Management Science Diploma elective course list

d) Add MSCI 718, 623 and 630 to ECE’s MEng Management Science Diploma elective course list – **Rationale for proposed changes**: MSCI is no longer offering MSCI 638, 646 and 632 and has launched new courses MSCI 718, 623 and 630.

Bruce Hellinga

BH: ag
Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies Office.

Faculty: Engineering

Programs:

1) Master of Management Sciences (MMSc) in Management Sciences
2) Master of Management Sciences (MMS) in Management Sciences – Co-operative Program

Program contact name(s): Lisa Hendel and Hossein Abouee Mehrizi (Associate Chair, Graduate Studies)

Form completed by: Lisa Hendel

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form (PC docx version or MAC docx version).

Removing previous course exemptions from the course requirements.

Changing admission minimum grade requirements for the Master’s level programs.

Is this a major modification to the program? No

Rationale for change(s):

Removing exemptions. Minor changes to course requirements.

Minor changes to course requirements and removing previous course exemptions.

Proposed effective date: Term: Fall Year: 2017

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/graduate-studies-academic-calendar/archive-fall-2016/engineering/department-management-sciences/master-management-sciences-mmSc

https://uwaterloo.ca/graduate-studies-academic-calendar/archive-fall-2016/engineering/department-management-sciences/master-management-sciences-mmSc-co-operative-program

<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Admission requirements</strong></td>
<td><strong>Admission requirements</strong></td>
</tr>
<tr>
<td>• Minimum requirements</td>
<td>• Minimum requirements</td>
</tr>
<tr>
<td>◦ An Honours Bachelor’s degree (or equivalent) with a minimum 75% standing in the last two years.</td>
<td>◦ The Department of Management Sciences requires either (i) a 75% overall standing in the last two years, or equivalent, in a relevant four-year Honours Bachelor’s degree or</td>
</tr>
</tbody>
</table>
Current Graduate Studies Academic Calendar content:

- Background in quantitative methods (e.g., Calculus, Linear Algebra, Probability and Statistics).
- All applicants must submit a "Statement of Purpose" - a one page statement addressing their academic background, area of research interest, proposed research studies.
- Applicants who fall slightly below the minimum academic requirements may be considered for admission as transitional or probationary students.

<table>
<thead>
<tr>
<th>Application materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Résumé/Curriculum vitae</td>
</tr>
<tr>
<td>Supplementary information form</td>
</tr>
<tr>
<td>Transcript(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of references: 3</td>
</tr>
<tr>
<td>Type of references: if the applicant has been working for several years, 1 business reference will be accepted along with 2 academic references.</td>
</tr>
</tbody>
</table>

| English language proficiency (ELP) (if applicable) |

Degree requirements

**Thesis option:**

- **Courses**
  - Students must demonstrate competency in the material covered by the following 4 General Requirement courses:
    - MSCI 603 Principles of Operations Research
    - MSCI 605 Organizational Theory and Behaviour
    - MSCI 607 Economic Concepts for Management
    - MSCI 609 Quantitative Data Analysis for Management Sciences

  *Competency can be established in any General Requirement course either by taking the course or by being exempted, based on previous studies of similar material. Exemption decisions are made by the instructor assigned to teach the General Requirements course in that year. The student may be equivalent; or (ii) a 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent, as the minimum requirement for admission to a Master's program for applicants educated at a Canadian institution. A 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent is the minimum requirement for admission to a Master's program for applicants educated outside of Canada.*

**Coursework option:**

- **Courses**
  - Students must successfully complete the following 4 general requirement courses (0.50 unit weight per course/4 units):
    - MSCI 603 Principles of Operations Research [This course may be replaced with MSCI 634 if a student has a strong background in Operations Research]
Current Graduate Studies Academic Calendar content:

- Students are required to demonstrate competency by taking an exam to qualify for an exemption.
  - In addition to the 4 General Requirement courses (MSCI 603, MSCI 605, MSCI 607, MSCI 609), students must take at least 4 additional courses, totaling a minimum requirement of 8 courses overall (0.50 unit weight per course/4 units). These courses may include at most 2 500-level courses approved by the Associate Chair for Graduate Studies. All other courses must be at the 600 and 700 level. Students must maintain an overall average of at least 73% at the end of each term, with no more than 2 failed courses overall.

Proposed Graduate Studies Academic Calendar content:

- MSCI 605 Organizational Theory and Behaviour
- MSCI 607 Applied Economics for Management
- MSCI 609 Quantitative Data Analysis for Management Sciences
  - In addition to the 4 General Requirement courses (MSCI 603, MSCI 605, MSCI 607, MSCI 609), students must take at least 4 additional courses (0.5 unit weight per course), totaling a minimum requirement of 8 courses overall. These courses may include at most 2 500-level courses approved by the Associate Chair for Graduate Studies. All other courses must be at the 600 and 700 level. Students must maintain an overall average of at least 73% at the end of each term, with no more than 2 failed courses overall.
  - No more than 1 course (0.50 unit weight per course) may be taken outside of the Management Sciences Department. This course will require the approval of the Associate Chair for Graduate Studies.
  - Students who have completed their BASc degree in Management Engineering at the University of Waterloo are required to choose their courses in consultation with the Associate Chair for Graduate Studies.

How will students currently registered in the program be impacted by these changes?

The students that have been admitted prior to Fall 2017 term must follow the previous degree requirements.

All new students starting the MMSc program in the Fall 2017 term must follow the new degree requirements.

Departmental approval date (03/06/17):
Reviewed by GSO (for GSO use only) □ date (mm/dd/yy):
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):
Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies Office.

Faculty: Engineering

Programs:
1) Master of Applied Science (MASc) in Management Sciences
2) Master of Applied Science (MASc) in Management Sciences – Co-operative Program

Program contact name(s): Lisa Hendel and Hossein Abouee Mehrizi (Associate Chair, Graduate Studies)

Form completed by: Lisa Hendel

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form (PC docx version or MAC docx version).

Changing the number of required courses from 5 to 4 and updating the course requirements.
Changing admission minimum grade requirements for the Master’s level programs.

Is this a major modification to the program? No

Rationale for change(s):
The program will be more research focused. The required core courses include advanced courses in all three research areas in Management Sciences Department.

Proposed effective date: Term: Fall Year: 2017

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Admission requirements</strong></td>
<td><strong>Admission requirements</strong></td>
</tr>
<tr>
<td>• Minimum requirements</td>
<td>• Minimum requirements</td>
</tr>
<tr>
<td>o An Honours Bachelor’s degree (or equivalent) with a minimum 75% standing in the last two years.</td>
<td>o The Department of Management Sciences requires either (i) a 75% overall standing in the last two years, or equivalent, in a relevant four-year Honours Bachelor’s degree or equivalent; or (ii) a 75% overall</td>
</tr>
<tr>
<td>o Background in quantitative methods (e.g., Calculus, Linear Algebra, Probability and Statistics).</td>
<td></td>
</tr>
</tbody>
</table>
Current Graduate Studies Academic Calendar content:

- All applicants must submit a "Statement of Purpose" - a one page statement addressing their academic background, area of research interest, proposed research studies.
  - Applicants who fall slightly below the minimum academic requirements may be considered for admission as transitional or probationary students.

- Application materials
  - Résumé/Curriculum vitae
  - Supplementary information form
  - Transcript(s)

- References
  - Number of references: 3
  - Type of references: if the applicant has been working for several years, 1 business reference will be accepted along with 2 academic references.

- English language proficiency (ELP) (if applicable)

Proposed Graduate Studies Academic Calendar content:

- All applicants must submit a "Statement of Purpose" - a one page statement addressing their academic background, area of research interest, proposed research studies.
  - Applicants who fall slightly below the minimum academic requirements may be considered for admission as transitional or probationary students.

- Application materials
  - Résumé/Curriculum vitae
  - Supplementary information form
  - Transcript(s)

- References
  - Number of references: 3
  - Type of references: if the applicant has been working for several years, 1 business reference will be accepted along with 2 academic references.

- English language proficiency (ELP) (if applicable)

Degree requirements

Thesis option:

- Courses
  - Students must demonstrate competency in the material covered by the following 3 General Requirement courses:
    - MSCI 603 Principles of Operations Research
    - MSCI 605 Organizational Theory and Behaviour
    - MSCI 607 Economic Concepts for Management
  - Competency can be established in any General Requirement course either by taking the course or by being exempted, based on previous studies of similar material. Exemption decisions are made by the instructor assigned to teach the General Requirements course in that year. The student may be required to demonstrate competency by taking an exam to qualify for an exemption.
  - In addition to the 3 General Requirement courses (MSCI 603, MSCI 605, MSCI 607), students must take at least 2 of the courses (0.50 unit weight per course) from the list of core courses.

- Core courses:
  - MSCI 605 Organizational Theory and Behaviour
### Current Graduate Studies Academic Calendar content:

- least 2 additional courses, totaling a minimum requirement of 5 courses overall (0.50 unit weight per course/2.50 units). Any student exempted from a General Requirement course must take another course, if necessary to satisfy the 5 course rule. These courses may include at most 1 500-level course approved by the Associate Chair for Graduate Studies. All other courses must be at the 600 and 700-level. Students must maintain an overall average of at least 73% at the end of each term, with no more than 2 failed courses overall.

### Proposed Graduate Studies Academic Calendar content:

- MSCI 607 Applied Economics for Management
- MSCI 623 Big Data Analytics
- MSCI 630 Human Computer Interaction
- MSCI 631 Probabilistic Models in Operations Research
- MSCI 634 Deterministic Models in Operations Research
- MSCI 641 Text Analytics

- All courses must be at the 600 and 700-level. Students must maintain an overall average of at least 73% at the end of each term, with no more than 2 failed courses overall.

- No more than 1 course (0.50 unit weight per course) may be taken outside the Management Sciences Department. This course will require the approval of the Associate Chair for Graduate Studies.

---

**How will students currently registered in the program be impacted by these changes?**

*The students that have been admitted prior to Fall 2017 term must follow the previous degree requirements.*

*All new students starting the MASc program in the Fall 2017 term must follow the new degree requirements.*

**Departmental approval date** (03/06/17):

**Reviewed by GSO** (for GSO use only) □ date (mm/dd/yy):

**Faculty approval date** (mm/dd/yy):

**Senate Graduate & Research Council (SGRC) approval date** (mm/dd/yy):

**Senate approval date** (mm/dd/yy) (if applicable):
Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies Office.

Faculty: Engineering

Programs:

Doctor of Philosophy (PhD) in Management Sciences

Program contact name(s): Lisa Hendel and Hossein Abouee Mehrizi (Associate Chair, Graduate Studies)

Form completed by: Lisa Hendel

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form (PC docx version or MAC docx version).

Changing the number of required courses from 6 to 4 and updating the course requirements.

Is this a major modification to the program? No

Rationale for change(s):

The program will be more research focused. The required core courses include advanced courses in all three research areas.

Proposed effective date: Term: Fall Year: 2017

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/graduate-studies-academic-calendar/archive-fall-2016/engineering/department-management-sciences/doctor-philosophy-phd-management-sciences

<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree requirements</td>
<td>Degree requirements</td>
</tr>
<tr>
<td>Thesis option:</td>
<td>Thesis option:</td>
</tr>
<tr>
<td>• Courses</td>
<td>• Courses</td>
</tr>
<tr>
<td>o Students in the program must demonstrate competency in the material covered by the following 3 courses:</td>
<td>o PhD candidates possessing a Master’s degree are required to take at least 4 courses (0.50 unit weight per course) of graduate credit. Students must successfully complete at least 2 courses (0.50 unit weight per course) from the list of core courses.</td>
</tr>
<tr>
<td>• MSCI 603 Principles of Operations Research</td>
<td>o All courses must be approved by the students’ supervisor.</td>
</tr>
<tr>
<td>• MSCI 605 Organizational Theory and Behaviour</td>
<td></td>
</tr>
<tr>
<td>Current Graduate Studies Academic Calendar content:</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>• MSCI 607 Economic Concepts for Management</td>
<td></td>
</tr>
<tr>
<td>○ Competency can be established in any General Requirement course either by taking the course or by being exempted, based on previous studies of similar material. Exemption decisions are made by the instructor assigned to teach the General Requirements course in that year. The student may be required to demonstrate competency by taking an exam to qualify for an exemption.</td>
<td></td>
</tr>
<tr>
<td>○ In addition to the General Requirement courses, students must take at least 3 courses (0.50 unit weight per course) at the 600 or 700-level, and maintain an overall average of at least 73% at the end of each term, with no more than 2 failed courses overall. These courses may include courses offered by other departments.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Core courses:</td>
</tr>
<tr>
<td>▪ MSCI 605 Organizational Theory and Behaviour</td>
</tr>
<tr>
<td>▪ MSCI 607 Applied Economics for Management</td>
</tr>
<tr>
<td>▪ MSCI 623 Big Data Analytics</td>
</tr>
<tr>
<td>▪ MSCI 630 Human Computer Interaction</td>
</tr>
<tr>
<td>▪ MSCI 631 Probabilistic Models in Operations Research</td>
</tr>
<tr>
<td>▪ MSCI 634 Deterministic Models in Operations Research</td>
</tr>
<tr>
<td>▪ MSCI 641 Text Analytics</td>
</tr>
<tr>
<td>○ Core courses may be replaced by other advanced courses if the student can demonstrate competency based on previous studies of similar material. The decision is made by the Associate Chair for Graduate Studies after the course replacement is recommended by the supervisor. The student may be required to demonstrate competency by taking an exam.</td>
</tr>
<tr>
<td>○ All courses must be at the 600 and 700-level. Students must maintain an overall average of at least 73% at the end of each term, with no more than 2 failed courses overall.</td>
</tr>
<tr>
<td>○ No more than 2 courses (0.50 unit weight per course) may be taken outside the Management Sciences Department. These courses will require the approval of the Associate Chair for Graduate Studies.</td>
</tr>
<tr>
<td>○ PhD candidates without a Master’s degree are required to take at least 8 courses (0.50 unit weight per course) of graduate credit. They must successfully complete at least 2 courses from the list of core courses.</td>
</tr>
</tbody>
</table>

How will students currently registered in the program be impacted by these changes?

*The students that have been admitted prior to Fall 2017 term must follow the previous degree requirements.*

*All new students starting the PhD program in the Fall 2017 term must follow the new degree requirements.*

**Departmental approval date** (03/06/17):
**Reviewed by GSO** (for GSO use only)  □  date (mm/dd/yy):
**Faculty approval date** (mm/dd/yy):
**Senate Graduate & Research Council (SGRC) approval date** (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☒ New ☐ Revision ☒ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: MSCI Course number: 603
Course Title (max. 100 characters incl. spaces): Principles of Operations Research
Course Short Title (max. 30 characters incl. spaces): Principles of Operations Research
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☐

Course Description: This course surveys a spectrum of models and techniques in Operations Research, with emphasis on applications. It focuses on the development of modeling skills, the interpretation of results, sensitivity analysis and computer implementations of decision support systems. Topics include linear, integer and network optimization models. Simulation analysis and other topics in stochastic processes may also be covered. The use of quantitative models in different levels of the decision making hierarchy are illustrated through case studies and readings from the Management Sciences literature. Priority may be given to Management Sciences students.

New course description (for revision only):

Meet Type(s): Lecture Choose an item.
Primary Meet Type: Lecture
Requisites: Anti-requisite-MSCI 634-Deterministic Models in Operations Research

Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☐ No ☒
Course Subject(s) to be cross-listed with and approval status: No
Sections combined/heldwith: No

Rationale for request: Adding anti-requisite-MSCI 634-Deterministic Models in Operations Research. (MSCI 634 is a new course)

Prepared by: Lisa Hendel Date: March 2, 2017
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☒ New ☒ Revision ☐ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: MSCI          Course number: 623
Course Title (max. 100 characters incl. spaces): Big Data Analytics
Course Short Title (max. 30 characters incl. spaces): Big Data Analytics
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☒ Instructor

Course Description: This course focuses on methods and algorithms for turning very large collections of data into actionable insight. Topics may include data profiling, transformation and cleaning, data mining, data warehousing and cloud computing. Applications will be drawn from various areas such as smart grid analytics and ubiquitous computing. Students will read and present papers and complete a research project. Priority may be given to Management Sciences students. Previous studies in programming, algorithms, statistics and database management are necessary background topics for those taking this course.

New course description (for revision only):

Meet Type(s): Lecture Reading
Primary Meet Type: Lecture
Requisites: Anti-requisite-MSCI 723-Big Data Analytics

Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☐ No ☒

Course Subject(s) to be cross-listed with and approval status: No
Sections combined/heldwith: No

Rationale for request: Changing numbering system from MSCI 723 (Big Data Analytics) to MSCI 623 (Big Data Analytics). To be consistent with core course numbering in Department.

Prepared by: Lisa Hendel Date: March 6, 2017
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☒ New ☐ Revision ☐ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: MSCI Course number: 630
Course Title (max. 100 characters incl. spaces): Human Computer Interaction
Course Short Title (max. 30 characters incl. spaces): Human Computer Interaction
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☒ Instructor

Course Description: This course concentrates on the theoretical and practical issues related to the design of the human-computer interfaces. Aspects of human perception, cognition and various models of task analysis are discussed. Further, the course examines the principles of interface design and the related empirical evidence. Priority may be given to Management Sciences students.

New course description (for revision only):

Meet Type(s): Lecture Reading
Primary Meet Type: Lecture
Requisites: Pre-requisite MSCI MSCI 605-Organizational Theory & Behaviour
Anti-requisite-MSCI 730, CS 649

Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☐ No ☒
Course Subject(s) to be cross-listed with and approval status: No
Sections combined/held with: No

Rationale for request: Changing numbering system from MSCI 730 (Human Computer Interaction) to MSCI 630 (Human Computer Interaction). To be consistent with core course numbering in Department.

Prepared by: Lisa Hendel Date: March 6, 2017
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☒ New ☒ Revision ☐ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: MSCI          Course number: 641
Course Title (max. 100 characters incl. spaces): Text Analytics
Course Short Title (max. 30 characters incl. spaces): Text Analytics
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☒ Instructor

Course Description: With the rapid growth of unstructured natural language data, such as web pages, blogs, product reviews, news articles and enterprise data, there is an increasing need for systems that would retrieve relevant documents, extract specific information from them, mine opinions, summarize and categorize texts. This course provides students with an understanding of the major methods for retrieving, mining and analyzing textual data, with the emphasis on algorithms, techniques and their evaluation.

New course description (for revision only):

Meet Type(s): Lecture Choose an item. Reading Choose an item.
Primary Meet Type: Lecture
Requisites: None

Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☐ No ☒
Course Subject(s) to be cross-listed with and approval status: No
Sections combined/heldwith: No

Rationale for request: This is a new course. All graduate students are permitted to take this course.

Prepared by: Lisa Hendel          Date: 6-Mar-17
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☐ New ☐ Revision ☐ Inactivation ☒
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: MSCI        Course number: 723
Course Title (max. 100 characters incl. spaces): Big Data Analytics
Course Short Title (max. 30 characters incl. spaces): Big Data Analytics
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☒ Instructor

Course Description: This course focuses on methods and algorithms for turning very large collections of data into actionable insight. Topics may include data profiling, transformation and cleaning, data mining, data warehousing and cloud computing. Applications will be drawn from various areas such as smart grid analytics and ubiquitous computing. Students will read and present papers and complete a research project. Priority may be given to Management Sciences students. Previous studies in programming, algorithms, statistics and database management are necessary background topics for those taking this course.

New course description (for revision only):

Meet Type(s): Lecture Choose an item. Reading Choose an item.
Primary Meet Type: Lecture
Requisites: None

Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☐ No ☒
Course Subject(s) to be cross-listed with and approval status: No
Sections combined/held with: No

Rationale for request: Changing from MSCI 723 to MSCI 623.

Prepared by: Lisa Hendel Date: 6-Mar-17
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☐ New ☐ Revision ☐ Inactivation ☒
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: MSCI Course number: 730
Course Title (max. 100 characters incl. spaces): Human Computer Interaction
Course Short Title (max. 30 characters incl. spaces): Human Computer Interaction
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☒ Instructor

Course Description:

This course concentrates on the theoretical and practical issues related to the design of human-computer interfaces. Aspects of human perception, cognition and various models of task analysis are discussed. Further, the course examines the principles of interface design and the related empirical evidence. Priority may be given to Management Sciences students.

New course description (for revision only):

Meet Type(s): Lecture Choose an item. Choose an item.
Primary Meet Type: Lecture
Requisites: Prerequisite: MSCI 605
Anti-requisite

Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☐ No ☒
Course Subject(s) to be cross-listed with and approval status: No
Sections combined/held with: No

Rationale for request: Changing from MSCI 730 to MSCI 630

Prepared by: Lisa Hendel Date: 28-Mar-17
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☒ New ☐ Revision ☐ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: MSCI
Course number: 634
Course Title (max. 100 characters incl. spaces): Deterministic Models in Operations Research
Course Short Title (max. 30 characters incl. spaces): Deterministic Models in OR
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☒ Instructor

Course Description: The objective of this course is to provide students with an in-depth understanding of the theory and algorithms in deterministic optimization. Specifically, it covers advanced topics in linear optimization including simplex method, duality, sensitivity analysis, and interior point methods. Then, topics in integer optimization including polyhedral theory, branch-and-bound, and cutting plane algorithm are discussed. Other topics such as nonlinear optimization and dynamic programming may be covered.

New course description (for revision only):

Meet Type(s): Lecture Choose an item. Reading Choose an item.
Primary Meet Type: Lecture

Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☒ No ☐

Course Subject(s) to be cross-listed with and approval status: No
Sections combined/held with: No

Rationale for request: Replacing MSCI 760-Topic 32 –Advanced Deterministic Optimization. All graduate students are permitted to take this course.

Prepared by: Lisa Hendel Date: March 6, 2017
MEMORANDUM

To: Bruce Hellinga, Associate Dean, Graduate Studies, Faculty of Engineering
Jennifer Collins, Manager, Engineering Graduate Studies Office

Copy: Elizabeth English, CWP Program Committee, Architecture
Marios Ioannidis, CWP Program Committee, Chemical Engineering
Kevin Boehmer, Managing Director, The Water Institute

From: Bruce MacVicar, Director, Collaborative Water Program, Civil & Environmental Engineering

Date: March 28, 2017

Subject: Collaborative Water Program Revision – Request for Faculty Approval

Attachments: A. Department Approvals
B. Program Revision Forms

Request

The purpose of this memorandum is to request faculty approval for a minor modification to the Collaborative Water Program (CWP). Please note that departments participating in the CWP from your faculty have approved the proposal (Attachment A). It would be appreciated if you can respond by email to Kevin Boehmer at the Water Institute indicating your Approval or Disapproval of the proposed modification at your earliest convenience.

Background

The Collaborative Water Program (CWP) was launched in 2013/14. The CWP Committee, which is comprised of representatives from the participating departments and schools, graduate students, and the Water Institute, is responsible for the design and delivery of the program. In late-2016, the CWP Committee identified opportunities to strengthen the program, in particular by recommending the addition of new course and milestone requirements for CWP PhD students who have completed a Masters CWP program. In addition, the committee is recommending that a research seminar, that is currently not mandatory, become a mandatory program milestone for all CWP students. The following table summarizes recommended CWP program revisions:

<table>
<thead>
<tr>
<th>Recommended CWP Program Revision</th>
<th>Associated Approval Forms a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Additional program requirement for all CWP students:</td>
<td>➢ CWP Program Revision Form&lt;br&gt;➢ CWP Research Seminar 1 Milestone Form</td>
</tr>
<tr>
<td>– Research seminar milestone.</td>
<td></td>
</tr>
<tr>
<td>2. New program requirements for CWP PhD students who have completed WATER 601 and WATER 602 as part of their Masters Water program:</td>
<td>➢ CWP Program Revision Form&lt;br&gt;➢ CWP Research Seminar 2 Milestone Form&lt;br&gt;➢ CWP Academic Contribution Milestone Form</td>
</tr>
<tr>
<td>– Course requirement;</td>
<td></td>
</tr>
<tr>
<td>– Milestone requirements.</td>
<td></td>
</tr>
<tr>
<td>3. Revised WATER 601 and WATER 602 course descriptions.</td>
<td>➢ WATER 601 Course Revision Form&lt;br&gt;➢ WATER 602 Course Revision Form</td>
</tr>
</tbody>
</table>

Note:

a Approval forms are included as Attachment B to this memorandum.
**Approvals Process**

On behalf of the CWP committee, the Water Institute is responsible for co-ordinating the following approvals for the proposed CWP program modification:

<table>
<thead>
<tr>
<th>Step</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Draft CWP program revisions reviewed by the Graduate Studies Office.</td>
<td>Completed December, 2016</td>
</tr>
<tr>
<td>2. Proposed program revisions considered for approval by departments/schools.</td>
<td>Completed January to March 2017</td>
</tr>
<tr>
<td>3. Proposed program revisions considered for approval by faculties. Faculties report decision to Kevin Boehmer.</td>
<td>March to April 2017</td>
</tr>
<tr>
<td>4. Proposed program revisions recommended for approval to the Senate Graduate and Research Council (SG&amp;RC) by the CWP lead academic unit (Faculty of Engineering) and the CWP Director (Bruce MacVicar) through the SC&amp;RC Secretary.</td>
<td>May 8 or June 12, 2017</td>
</tr>
</tbody>
</table>

Thank you for your ongoing support of the CWP. Please feel free to contact Kevin Boehmer or me with any questions or for any additional information.
Hi Kevin,

The School of Architecture approves the proposed modifications to the Collaborative Water program.

Best,

Emily Stafford
Coordinator Graduate Studies and Research
School of Architecture
University of Waterloo
T: 519.888.4567 ext 27603
https://uwaterloo.ca/architecture/

Kevin,

Yes, I concur that CEE has approved your motion. This will be reflected in our Department meeting minutes. Please proceed.

- Jeff

Jeff West, Ph.D, P.Eng, FACI
Professor
Civil and Environmental Engineering
University of Waterloo
(519) 888-4567 Ext 33323
From: Judy Caron  
Sent: Tuesday, March 28, 2017 10:55 AM  
To: Kevin Boehmer <kboehmer@uwaterloo.ca>  
Subject: FW: Collaborative Water Program Revision for Department/School Approval

Hi Kevin;

It was in fact approved.

Thank you,

Judy Caron  
Administrative Co-Ordinator,  
Graduate Studies,  
Chemical Engineering, E6-3028  
1-519-888-4567, ext.32620  
judy.caron@uwaterloo.ca

From: Liz Bevan  
Sent: March-28-17 10:54 AM  
To: Judy Caron <judy.caron@uwaterloo.ca>  
Subject: RE: Collaborative Water Program Revision for Department/School Approval

Yes it was.  
Liz

From: Judy Caron  
Sent: Tuesday, March 28, 2017 10:43 AM  
To: Liz Bevan <eabevan@uwaterloo.ca>  
Subject: FW: Collaborative Water Program Revision for Department/School Approval

Hi Liz;

Was this by chance approved at the last meeting?  

Judy Caron  
Administrative Co-Ordinator,  
Graduate Studies,  
Chemical Engineering, E6-3028  
1-519-888-4567, ext.32620  
judy.caron@uwaterloo.ca

From: Kevin Boehmer  
Sent: March-28-17 8:23 AM  
To: Judy Caron <judy.caron@uwaterloo.ca>  
Cc: Jennifer Collins <jecollins@uwaterloo.ca>; Yuning Li <yuning.li@uwaterloo.ca>  
Subject: RE: Collaborative Water Program Revision for Department/School Approval

Hi Judy-

Are you able to confirm that the Department of Chemical Engineering approved the proposed CWP revisions?

Thanks very much, Kevin
Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies Office.

Faculty: Arts, Engineering, Environment, Mathematics, Science

Program: Collaborative Water Program

Program contact name(s): Bruce MacVicar (Engineering), Kevin Boehmer (Water Institute)

Form completed by: Kevin Boehmer

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form (PC docx version or MAC docx version).

The proposed Collaborative Water Program (CWP) revision includes the following changes:

1. Revised course descriptions for WATER 601 and WATER 602 (see SGRC Course Revision forms);
2. New program requirements for PhD Water students who have completed WATER 601 and WATER 602 as part of their Master’s Water program;
3. New milestone requirements (see SGRC New Milestone forms).

Is this a major modification to the program? No

Rationale for change(s):

The Collaborative Water Program was launched in 2013/14, with the program’s fourth cohort of students entering the program in 2016/17. The proposed program revisions are both administrative and substantive. Proposed administrative changes include WATER 601 and WATER 602 course description updates that better reflect current pedagogy and content. The proposed substantive change updates the program to reflect an emerging demand from students who have completed the Masters Water program, and who then want to enter the PhD Water program. Currently, Collaborative Water Program requirements for PhD and Masters students are identical. The proposed program change will add new course and milestone requirements for PhD Water students who have completed the Masters Water program, allowing Waterloo to retain these students while maintaining the integrity of the program. In addition, a new Research Seminar milestone has been added for all students, and two new milestones added for PhD Water students who have completed the Masters Water program at Waterloo.

Proposed effective date: Term: Fall Year: 2017

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/graduate-studies-academic-calendar/mathematics/department-applied-mathematics/master-mathematics-mmath-applied-mathematics-water

https://uwaterloo.ca/graduate-studies-academic-calendar/mathematics/department-applied-mathematics/doctor-philosophy-phd-applied-mathematics-water

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/school-architecture/master-architecture-march-water
<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Courses</strong></td>
<td><strong>Courses</strong></td>
</tr>
<tr>
<td>• The Water core courses are designed to provide</td>
<td>• This degree is offered through the Collaborative</td>
</tr>
<tr>
<td>fundamental multidisciplinary knowledge and</td>
<td>Water Program. This program, jointly offered by a</td>
</tr>
<tr>
<td>experience to complement the student’s specialist</td>
<td>range of departments across several academic</td>
</tr>
<tr>
<td>courses and water-related research.</td>
<td>faculties, promotes the development of</td>
</tr>
<tr>
<td></td>
<td>interdisciplinary perspectives on water.</td>
</tr>
<tr>
<td></td>
<td>Collaborative Water Program students complete</td>
</tr>
<tr>
<td></td>
<td>their specialist training in their respective home</td>
</tr>
<tr>
<td></td>
<td>departments, while working with colleagues from</td>
</tr>
<tr>
<td></td>
<td>a variety of other departments in core</td>
</tr>
<tr>
<td></td>
<td>interdisciplinary courses (WATER 601 and WATER</td>
</tr>
<tr>
<td></td>
<td>602).</td>
</tr>
<tr>
<td><strong>Water core courses:</strong></td>
<td>**All Collaborative Water Program students must</td>
</tr>
<tr>
<td>• WATER 601 Integrated Water Management</td>
<td>complete the following core courses:</td>
</tr>
<tr>
<td>• WATER 602 Integrated Water Management Project</td>
<td>• WATER 601 Integrated Water Management</td>
</tr>
<tr>
<td></td>
<td>• WATER 602 Integrated Water Management</td>
</tr>
<tr>
<td></td>
<td>***** for PhD programs only***</td>
</tr>
<tr>
<td></td>
<td>• Students who have already completed WATER 601</td>
</tr>
<tr>
<td></td>
<td>and WATER 602 as part of their Masters Water</td>
</tr>
<tr>
<td></td>
<td>degree, must complete the following course</td>
</tr>
<tr>
<td></td>
<td>requirement:</td>
</tr>
<tr>
<td></td>
<td>• One graduate level water course from outside</td>
</tr>
<tr>
<td></td>
<td>the student’s home faculty agreed to by the</td>
</tr>
<tr>
<td></td>
<td>student’s Supervisor and the Collaborative</td>
</tr>
<tr>
<td></td>
<td>Water Program Director.</td>
</tr>
<tr>
<td><strong>Milestones</strong></td>
<td><strong>Milestones</strong></td>
</tr>
<tr>
<td>• All Collaborative Water Program students must</td>
<td>• All Collaborative Water Program students must</td>
</tr>
<tr>
<td>complete the Collaborative Water Program Research</td>
<td>complete the Collaborative Water Program</td>
</tr>
<tr>
<td><strong>Collaborative Water Program Research Seminar 1</strong></td>
<td></td>
</tr>
<tr>
<td>The student is required to present a seminar on</td>
<td></td>
</tr>
<tr>
<td>their thesis or major paper research proposal and,</td>
<td></td>
</tr>
<tr>
<td>if appropriate, early stage results to current and</td>
<td></td>
</tr>
<tr>
<td>past water students and Water Institute faculty</td>
<td></td>
</tr>
<tr>
<td>members. Seminars will normally occur following</td>
<td></td>
</tr>
<tr>
<td>the completion of WATER 601 and WATER 602.</td>
<td></td>
</tr>
<tr>
<td>Seminars will provide the opportunity for students</td>
<td></td>
</tr>
<tr>
<td>to discuss how learnings from water courses were</td>
<td></td>
</tr>
<tr>
<td>applied in, or influenced, research proposals or</td>
<td></td>
</tr>
<tr>
<td>research work in the student’s home department.</td>
<td></td>
</tr>
<tr>
<td>Seminars will normally be poster presentations at</td>
<td></td>
</tr>
<tr>
<td>Water Institute organized events. The seminar is</td>
<td></td>
</tr>
<tr>
<td>not an oral examination of the thesis or paper;</td>
<td></td>
</tr>
<tr>
<td>rather, its purpose is to develop the student’s</td>
<td></td>
</tr>
<tr>
<td>ability to communicate their research in an</td>
<td></td>
</tr>
<tr>
<td>organized and informative manner.</td>
<td></td>
</tr>
<tr>
<td>Current Graduate Studies Academic Calendar content:</td>
<td>Proposed Graduate Studies Academic Calendar content:</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Department Consent Required</td>
<td><strong>Department Consent Required</strong></td>
</tr>
<tr>
<td>WATER Grad Students Only</td>
<td><strong>WATER Grad Students Only</strong></td>
</tr>
<tr>
<td>***** for PhD programs only***</td>
<td>***** for PhD programs only***</td>
</tr>
<tr>
<td>• Students who have completed the Collaborative Water Program Research Seminar 1 as part of their Masters Water degree, must complete the following two milestones:</td>
<td>• Students who have completed the Collaborative Water Program Research Seminar 1 as part of their Masters Water degree, must complete the following two milestones:</td>
</tr>
<tr>
<td>▪ Collaborative Water Program Research Seminar 2;</td>
<td>▪ Collaborative Water Program Research Seminar 2;</td>
</tr>
<tr>
<td>▪ Collaborative Water Program Academic Contribution.</td>
<td>▪ Collaborative Water Program Academic Contribution.</td>
</tr>
</tbody>
</table>

**Collaborative Water Program Research Seminar 2 Milestone**

The student is required to present a seminar on their PhD thesis proposal to current and past water students and Water Institute faculty members. Seminars will normally occur following the completion of required courses and the comprehensive exam. Seminars should present how learnings from the Collaborative Water Program were applied in, or influenced, thesis proposals. Seminars will normally be poster presentations or talks at Water Institute organized events. The seminar is not an oral examination of the thesis proposal; rather, its purpose is to develop the student’s ability to communicate their research in an organized and informative manner.

**Department Consent Required**

**WATER Grad Students Only**

**Collaborative Water Program Academic Contribution Milestone**

The student is required to make an academic contribution to the Collaborative Water Program. The proposed contribution will be documented by the student and approved by the student’s Supervisor and the Collaborative Water Program Director. Potential contributions may include, but not be limited to:

- Development of new or improved curricula or course content;
- Delivery of a lecture(s);
- Preparation of a publication;
- Preparation of a case study;
- Mentorship of a group of students.

**Department Consent Required**
<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER Grad Students Only</td>
<td>• For more information on the Collaborative Water Program, visit: <a href="https://uwaterloo.ca/water-institute/education/collaborative-water-program">https://uwaterloo.ca/water-institute/education/collaborative-water-program</a>.</td>
</tr>
</tbody>
</table>

How will students currently registered in the program be impacted by these changes?

**Revised for Approval by Faculties**

*Only PhD Water students who have completed Master Water degrees at Waterloo will be impacted. There is one student currently enrolled in the program who meets this criteria. This student, who is in Term 2 of their PhD, must meet the CWP program requirements at the time of their admission, or may choose to meet the new program requirements.*

**Approved by Departments**

*Only PhD Water students who have completed Master Water degrees at Waterloo will be impacted. There is one student currently enrolled in the program who meets this criteria. This student, who is in Term 1 of their PhD, will be expected to meet the new program requirements.*

**Departmental approval date** (mm/dd/yy):  
**Reviewed by GSO** (for GSO use only) ☒ date (mm/dd/yy): 12/16/2016  
**Faculty approval date** (mm/dd/yy):  
**Senate Graduate & Research Council (SGRC) approval date** (mm/dd/yy):  
**Senate approval date** (mm/dd/yy) (if applicable):
Faculty: Choose an item. Arts, Engineering, Environment, Mathematics, Science
Effective term: Term/Year Fall 2017

Course ☐ New ☐ Revision ☐ Inactivation ☐
Milestone ☒ New ☒ Revision ☐ Inactivation ☐
New milestone title: Collaborative Water Program Research Seminar 1

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: WATER Course number:
Course Title (max. 100 characters incl. spaces):
Course Short Title (max. 30 characters incl. spaces):
Grading Basis: CREDIT/NO CREDIT
Course Credit Weight: Choose an item.
Course Consent Required: ☐ Choose an item.
Course Description:
New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.
Primary Meet Type: Choose an item.
Requisites:

Special topics course: Yes ☐ No ☐
Cross-listed: Yes ☐ No ☐
Course Subject(s) to be cross-listed with and approval status:
Sections combined/held with:

Rationale for request:

The Collaborative Water Program Committee is comprised of representatives from the participating departments and schools, graduate students and the Water Institute. The Program Committee is responsible for the design and delivery of the Collaborative Water Program, and has agreed that a new seminar milestone should be included as a program requirement.

Dr. Bruce MacVicar, Collaborative Water Program Director

Prepared by: Date: 20-Dec-16
Faculty: Choose an item. Arts, Engineering, Environment, Mathematics, Science
Effective term: Term/Year Fall 2017

Course ☐ New ☐ Revision ☐ Inactivation ☐
Milestone ☒ New ☒ Revision ☐ Inactivation ☐
New milestone title: Collaborative Water Program Research Seminar 2

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: WATER Course number:
Course Title (max. 100 characters incl. spaces):
Course Short Title (max. 30 characters incl. spaces):
Grading Basis: CEDIT/NO CREDIT
Course Credit Weight: Choose an item.
Course Consent Required: ☐ Choose an item.
Course Description:
New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.
Primary Meet Type: Choose an item.
Requisites:

Special topics course: Yes ☐ No ☐
Cross-listed: Yes ☐ No ☐
Course Subject(s) to be cross-listed with and approval status:
Sections combined/held with:

Rationale for request:

The Collaborative Water Program Committee is comprised of representatives from the participating departments and schools, graduate students and the Water Institute. The Program Committee is responsible for the design and delivery of the Collaborative Water Program, and has agreed that a new research seminar milestone should be included as a program requirement for PhD Water students who have completed a Masters Water degree at Waterloo.

Dr. Bruce MacVicar, Collaborative Water Program Director

Prepared by: Date: 20-Dec-16
Faculty: Choose an item. Arts, Engineering, Environment, Mathematics, Science

Effective term: Term/Year Fall 2017

Course ☐ New ☐ Revision ☐ Inactivation ☐

Milestone ☒ New ☒ Revision ☐ Inactivation ☐

New milestone title: Collaborative Water Program Academic Contribution

For course revisions, indicate the type(s) of changes:
(e.g. consent, description, title, requisites)

Course Subject code: WATER Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required: ☐ Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

Requisites:

Special topics course: Yes ☐ No ☐

Cross-listed: Yes ☐ No ☐

Course Subject(s) to be cross-listed with and approval status:

Sections combined/held with:

Rationale for request:

The Collaborative Water Program Committee is comprised of representatives from the participating departments and schools, graduate students and the Water Institute. The Program Committee is responsible for the design and delivery of the Collaborative Water Program, and has agreed that a new academic contribution milestone should be included as a program requirement for PhD Water students who have completed a Masters Water degree at Waterloo.

Dr. Bruce MacVicar, Collaborative Water Program Director

Prepared by: Date: 20-Dec-16
Faculty: Choose an item. Arts, Engineering, Environment, Mathematics, Science
Effective term: Term/Year Fall 2017

Course ☒ New ☐ Revision ☒ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes: Course description

Course Subject code: WATER Course number: 601
Course Title (max. 100 characters incl. spaces): Introduction to Integrated Water Management
Course Short Title (max. 30 characters incl. spaces): Integrated Water Management
Grading Basis: Choose an item.
Course Credit Weight: Choose an item.
Course Consent Required: ☐ Choose an item.
Course Description:
New course description (for revision only):

This course provides an overview of current issues and challenges in water research and management from a variety of disciplines, including water science, engineering, governance and economics perspectives. The purpose is to provide students with a broad knowledge base of the key theories, concepts and terminology from various water-related fields, and to allow them to develop connections with peers, water researchers and professionals in other areas of study.

Case studies that demonstrate the complexity and opportunities for interdisciplinary water research and innovation, and that allow students to collaboratively explore ideas, will be examined. Seminars, presentations and discussions with faculty members and professionals from different disciplines will introduce students to current research and practice. Course readings will focus on key concepts, perspectives and terminology from multiple disciplines.

Department Consent Required
WATER Grad Students Only

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.
Primary Meet Type: Choose an item.

Requisites:

Special topics course: Yes ☐ No ☐
Cross-listed: Yes ☐ No ☐
Rationale for request:

The Collaborative Water Program was launched in 2013/14, with the program’s fourth cohort of students entering the program in 2016/17. The proposed changes reflect the current pedagogy and content of WATER 601.

Bruce MacVicar, CWP Program Director

Prepared by: Date: 20-Dec-16
Faculty:    Choose an item. Arts, Engineering, Environment, Mathematics, Science
Effective term:    Term/Year Fall 2017

Course ☒ New ☐ Revision ☒ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title:    Choose an item.

For course revisions, indicate the type(s) of changes: Course description, meet type and prerequisite.

Course Subject code:    WATER Course number:    602
Course Title (max. 100 characters incl. spaces):    Integrated Water Resources Management Project
Course Short Title (max. 30 characters incl. spaces):    Integrated Water Project

Grading Basis:    Choose an item.
Course Credit Weight:    Choose an item.
Course Consent Required:    ☐    Choose an item.
Course Description:
New course description (for revision only):

This course builds on WATER 601 and focuses on the Grand River Watershed. The course normally includes a six to eight day field trip held at the beginning of the term, followed by one or two seminar sessions during the first month of the term. The field trip will allow students to examine specific watershed components, landscapes, infrastructure and conditions from interdisciplinary perspectives. Students will travel across the watershed and meet water practitioners, managers, scientists, volunteers and others concerned with watershed health to learn first-hand about watershed issues and management approaches.

Based on the interactive field trips and supporting materials, a multidisciplinary group project will be required where students identify an approach to investigating an emerging watershed issue.

Department Consent Required
WATER Grad Students Only
Prereq:    WATER 601

Meet Type(s):    Seminar Choose an item. Choose an item. Choose an item.
Primary Meet Type:    Seminar
PreRequisite:    WATER 601

Special topics course:    Yes ☐ No ☒
Cross-listed:    Yes ☐ No ☒
Rationale for request:

The Collaborative Water Program was launched in 2013/14, with the program’s fourth cohort of students entering the program in 2016/17. The proposed changes reflect the current pedagogy and content of WATER 602.

Bruce MacVicar, CWP Program Director

Prepared by: Date: 20-Dec-16
Memorandum

Date: March 20, 2017

To: Bruce Hellinga, Associate Dean, Graduate Studies, Faculty of Engineering

From: Sherman Shen, Associate Chair, Graduate Studies, Electrical and Computer Engineering

Subject: Calendar Changes

The department of Electrical and Computer Engineering would like to request the following calendar revisions:

- Add ECE 642: Radio Frequency Integrated Circuit Design to Circuits and Systems, Silicon Devices and Integrated Circuits, and VLSI’s core course lists
- Add NE 479-T1 and NE 472 as anti-req for ECE 634.
- Remove MSCI 638, 646 and 632 from ECE’s MEng Management Science Diploma elective course list
- Add MSCI 718, 623 and 630 from ECE’s MEng Management Science Diploma elective course list

These changes were approved at a regular meeting of the Electrical and Computer Engineering Department on March 16, 2017.

Regards,

Sherman Shen
Associate Chair, Graduate Studies
Electrical & Computer Engineering
EIT Building, Room 4155
University of Waterloo

Tel: 519-888-4567 ext. 32691
Fax: 519-746-3077
Email: sshen@uwaterloo.ca
/SL
Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies Office.

Faculty: Engineering

Program: Electrical and Computer Engineering MASc and PhD

Program contact name(s): Sarah Landy

Form completed by: Sarah Landy

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form (PC docx version or MAC docx version).

Add ECE 642: Radio Frequency Integrated Circuit Design to Circuits and Systems, Silicon Devices and Integrated Circuits, and VLSI’s core course lists

Is this a major modification to the program? No

Rationale for change(s):

New Course, not previously offered

Proposed effective date: Term: Fall Year: 2017

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-electrical-and-computer-engineering/master-applied-science-masc-electrical-and-computer-engineering

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-electrical-and-computer-engineering/doctor-philosophy-phd-electrical-and-computer-engineering

Current Graduate Studies Academic Calendar content: Proposed Graduate Studies Academic Calendar content:

Core courses:

- Antennas, Microwaves, and Wave Optics
  - ECE 642 Radio Frequency Integrated Circuit Design
  - ECE 671 Microwave and RF Engineering
  - ECE 672 Optoelectronic Devices
  - ECE 675 Radiation and Propagation of Electromagnetic Fields
  - ECE 676 (QIC 750) Quantum Information Processing Devices

Core courses:

- Antennas, Microwaves, and Wave Optics
  - ECE 642 Radio Frequency Integrated Circuit Design
  - ECE 671 Microwave and RF Engineering
  - ECE 672 Optoelectronic Devices
  - ECE 675 Radiation and Propagation of Electromagnetic Fields
  - ECE 676 (QIC 750) Quantum Information Processing Devices
<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Circuits and Systems o ECE 677 (QIC 885) Quantum Electronics and Photonics</td>
<td>• Circuits and Systems o ECE 677 (QIC 885) Quantum Electronics and Photonics</td>
</tr>
<tr>
<td>• Communications and Information Systems o ECE 603 Statistical Signal Processing o ECE 604 Stochastic Processes o ECE 610 Broadband Communication Networks o ECE 611 Digital Communications o ECE 612 Information Theory</td>
<td>• Communications and Information Systems o ECE 603 Statistical Signal Processing o ECE 604 Stochastic Processes o ECE 610 Broadband Communication Networks o ECE 611 Digital Communications o ECE 612 Information Theory</td>
</tr>
<tr>
<td>• Computer Hardware o ECE 606 Algorithm Design o ECE 621 Computer Organization o ECE 627 Register-transfer-level Digital Systems o ECE 637 Digital Integrated Circuits</td>
<td>• Computer Hardware o ECE 606 Algorithm Design o ECE 621 Computer Organization o ECE 627 Register-transfer-level Digital Systems o ECE 637 Digital Integrated Circuits</td>
</tr>
<tr>
<td>• Nanotechnology o ECE 630 Physics and Models of Semiconductor Devices o ECE 633 Nanoelectronics o ECE 634 Organic Electronics o ECE 635 Fabrication in the Nanoscale: Principles, Technology and Applications o ECE 672 Optoelectronic Devices</td>
<td>• Nanotechnology o ECE 630 Physics and Models of Semiconductor Devices o ECE 633 Nanoelectronics o ECE 634 Organic Electronics o ECE 635 Fabrication in the Nanoscale: Principles, Technology and Applications o ECE 672 Optoelectronic Devices</td>
</tr>
<tr>
<td>• PAMI - Pattern Analysis and Machine Intelligence o ECE 606 Algorithm Design and Analysis o ECE 613 Image Processing and Visual Communication o ECE 657 Tools of Intelligent Systems Design o ECE 657A Data and Knowledge Modelling and Analysis o ECE 659 Intelligent Sensors and Sensor Networks</td>
<td>• PAMI - Pattern Analysis and Machine Intelligence o ECE 606 Algorithm Design and Analysis o ECE 613 Image Processing and Visual Communication o ECE 657 Tools of Intelligent Systems Design o ECE 657A Data and Knowledge Modelling and Analysis</td>
</tr>
<tr>
<td>Current Graduate Studies Academic Calendar content:</td>
<td>Proposed Graduate Studies Academic Calendar content:</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>• Power and Energy Systems</td>
<td>o ECE 659 Intelligent Sensors and Sensor Networks</td>
</tr>
<tr>
<td>o ECE 662 Power Systems Analysis and Control</td>
<td>• Power and Energy Systems</td>
</tr>
<tr>
<td>o ECE 663 Energy Processing</td>
<td>o ECE 662 Power Systems Analysis and Control</td>
</tr>
<tr>
<td>o ECE 665 High Voltage Engineering Applications</td>
<td>o ECE 663 Energy Processing</td>
</tr>
<tr>
<td>o ECE 666 Power Systems Operation</td>
<td>o ECE 665 High Voltage Engineering Applications</td>
</tr>
<tr>
<td>o ECE 668 Distribution System Engineering</td>
<td>o ECE 666 Power Systems Operation</td>
</tr>
<tr>
<td>• Quantum Information</td>
<td>o ECE 668 Distribution System Engineering</td>
</tr>
<tr>
<td>o QIC 710 Quantum Information Processing</td>
<td>• Quantum Information</td>
</tr>
<tr>
<td>o ECE 677(QIC 885) Quantum Electronics and Photonics</td>
<td>o QIC 710 Quantum Information Processing</td>
</tr>
<tr>
<td>o ECE 676 (QIC750) Quantum Information Processing Devices</td>
<td>o ECE 677(QIC 885) Quantum Electronics and Photonics</td>
</tr>
<tr>
<td>• Silicon Devices and Integrated Circuits</td>
<td>o ECE 676 (QIC750) Quantum Information Processing Devices</td>
</tr>
<tr>
<td>o ECE 630 Physics and Models of Semiconductor Devices</td>
<td>• Silicon Devices and Integrated Circuits</td>
</tr>
<tr>
<td>o ECE 631 Microelectronic Processing Technology</td>
<td>o ECE 630 Physics and Models of Semiconductor Devices</td>
</tr>
<tr>
<td>o ECE 634 Organic Electronics</td>
<td>o ECE 631 Microelectronic Processing Technology</td>
</tr>
<tr>
<td>o ECE 636 Advanced Analog Integrated Circuits</td>
<td>o ECE 634 Organic Electronics</td>
</tr>
<tr>
<td>o ECE 671 Microwave and RF Engineering</td>
<td>o ECE 636 Advanced Analog Integrated Circuits</td>
</tr>
<tr>
<td>o ECE 672 Optoelectronic Devices</td>
<td>o ECE 642: Radio Frequency Integrated Circuit Design</td>
</tr>
<tr>
<td>• Systems and Controls</td>
<td>o ECE 671 Microwave and RF Engineering</td>
</tr>
<tr>
<td>o ECE 602 (CO 602) Introduction to Optimization</td>
<td>o ECE 672 Optoelectronic Devices</td>
</tr>
<tr>
<td>o ECE 604 (STAT 901) Stochastic Processes</td>
<td>• Systems and Controls</td>
</tr>
<tr>
<td>o ECE 682 Multivariable Control Systems</td>
<td>o ECE 602 (CO 602) Introduction to Optimization</td>
</tr>
<tr>
<td>o ECE 686 Filtering and Control of Stochastic Linear Systems</td>
<td>o ECE 604 (STAT 901) Stochastic Processes</td>
</tr>
<tr>
<td>o ECE 688 Nonlinear Systems</td>
<td>o ECE 682 Multivariable Control Systems</td>
</tr>
<tr>
<td>• VLSI - Very Large Scale Integration</td>
<td>o ECE 686 Filtering and Control of Stochastic Linear Systems</td>
</tr>
<tr>
<td>o ECE 636 Advanced Analog Integrated Circuits</td>
<td>o ECE 688 Nonlinear Systems</td>
</tr>
<tr>
<td>o ECE 637 Digital Integrated Circuits</td>
<td>• VLSI - Very Large Scale Integration</td>
</tr>
<tr>
<td>o ECE 671 Microwave and RF Engineering</td>
<td>o ECE 637 Digital Integrated Circuits</td>
</tr>
<tr>
<td>• Wireless Communication</td>
<td>o ECE 642: Radio Frequency Integrated Circuit Design</td>
</tr>
<tr>
<td>o ECE 603 Statistical Signal Processing</td>
<td>o ECE 636 Advanced Analog Integrated Circuits</td>
</tr>
<tr>
<td>o ECE 604 Stochastic Processes</td>
<td>o ECE 637 Digital Integrated Circuits</td>
</tr>
<tr>
<td>o ECE 610 Broadband Communication Networks</td>
<td>o ECE 642: Radio Frequency Integrated Circuit Design</td>
</tr>
<tr>
<td>o ECE 611 Digital Communications</td>
<td>o ECE 671 Microwave and RF Engineering</td>
</tr>
<tr>
<td>o ECE 612 Information Theory</td>
<td>• Wireless Communication</td>
</tr>
<tr>
<td></td>
<td>o ECE 603 Statistical Signal Processing</td>
</tr>
<tr>
<td></td>
<td>o ECE 604 Stochastic Processes</td>
</tr>
<tr>
<td>Current Graduate Studies Academic Calendar content:</td>
<td>Proposed Graduate Studies Academic Calendar content:</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>o ECE 610 Broadband Communication Networks</td>
</tr>
<tr>
<td></td>
<td>o ECE 611 Digital Communications</td>
</tr>
<tr>
<td></td>
<td>o ECE 612 Information Theory.</td>
</tr>
</tbody>
</table>

How will students currently registered in the program be impacted by these changes?

Additional option for core course choice in those research areas

Departmental approval date (mm/dd/yy): 03/16/17
Reviewed by GSO (for GSO use only) □ date (mm/dd/yy):
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):
Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies Office.

Faculty: Engineering

Program: Electrical and Computer Engineering – MEng Graduate Diploma (GDip) in Management Sciences

Program contact name(s): Sarah Landy

Form completed by: Sarah Landy

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form (PC docx version or MAC docx version).

- Remove MSCI 638, 646 and 632 from ECE’s MEng Management Science Diploma elective course list
- Add MSCI 718, 723 and 730 from ECE’s MEng Management Science Diploma elective course list.

Is this a major modification to the program? No

Rationale for change(s):

MSCI is no longer offering MSCI 638, 646 and 632 and has launched new courses MSCI 718, 623 and 630.

Proposed effective date: Term: Fall Year: 2017

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-electrical-and-computer-engineering/graduate-diploma-gdip-management-sciences

<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective courses (choose 3 from the following list):</td>
<td>Elective courses (choose 3 from the following list):</td>
</tr>
<tr>
<td>- MSCI 602 Strategic Management Technology</td>
<td>- MSCI 602 Strategic Management Technology</td>
</tr>
<tr>
<td>- MSCI 605 Organizational Theory &amp; Behaviour</td>
<td>- MSCI 605 Organizational Theory &amp; Behaviour</td>
</tr>
<tr>
<td>- MSCI 632 Discrete Event Simulation</td>
<td>- MSCI 623 Big Data Analytics</td>
</tr>
<tr>
<td>- MSCI 633 Production and Inventory Management</td>
<td>- MSCI 630 Human Computer Interaction</td>
</tr>
<tr>
<td>- MSCI 638 Information Systems Analysis and Design</td>
<td>- MSCI 633 Production and Inventory Management</td>
</tr>
<tr>
<td>- MSCI 646 Database Management Systems</td>
<td>- MSCI 712 Decision Analysis Under Uncertainty</td>
</tr>
<tr>
<td>- MSCI 712 Decision Analysis Under Uncertainty</td>
<td>- MSCI 718 Statistical Methods for Data Analytics</td>
</tr>
</tbody>
</table>

How will students currently registered in the program be impacted by these changes?
Current students will have the option of applying the new courses to their GDip. The courses that are being removed will still count towards the GDip requirements provided they were completed prior to this revision being published in the Graduate Student Calendar.

Departmental approval date (mm/dd/yy): 03/16/17
Reviewed by GSO (for GSO use only) □ date (mm/dd/yy):
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):
Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies Office.

Faculty: Engineering
Program: Electrical and Computer Engineering
Program contact name(s): Sarah Landy
Form completed by: Sarah Landy

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form (PC docx version or MAC docx version).

Add course anti-reqs.

Is this a major modification to the program? No

Rationale for change(s):

Course formally called ECE 730-T18 – NE 479-T1 and NE 472 were anti-reqs and held withs which never got carried over in the course renumbering.

Proposed effective date: Term: Fall Year: 2017

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/graduate-studies-academic-calendar/node/2786

<table>
<thead>
<tr>
<th>Current Graduate Studies Academic Calendar content:</th>
<th>Proposed Graduate Studies Academic Calendar content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisites: Anitreq: ECE 730 - Topic 18</td>
<td>Requisites: Anitreq: ECE 730 - Topic 18, <strong>NE 479-T1 and NE 472</strong></td>
</tr>
</tbody>
</table>

How will students currently registered in the program be impacted by these changes?

None

Departmental approval date (mm/dd/yy): 03/16/17
Reviewed by GSO (for GSO use only) □ date (mm/dd/yy):
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):
Faculty: Engineering
Effective term: Term/Year Fall 2017

Course ☒ New ☐ Revision ☒ Inactivation ☐
Milestone ☐ New ☐ Revision ☐ Inactivation ☐

New milestone title:
For course revisions, indicate the type(s) of changes: add anti-requisites (e.g. consent, description, title, requisites)

Course Subject code: ECE Course number: 634
Course Title (max. 100 characters incl. spaces): Organic Electronics
Course Short Title (max. 30 characters incl. spaces): Organic Electronics
Grading Basis: NUMERICAL
Course Credit Weight: 0.50
Course Consent Required: ☐

Course Description: The course gives an overview of organic electronic and optoelectronic devices. It begins with a review of electronic structure of single organic molecules as a guide to the electronic behaviour of organic aggregates. Various relevant material phenomena are reviewed; including topics from photophysics (absorption and emission of light, excited states, radiative and non-radiative transitions), intermolecular charge transport mechanisms (hopping, disorder), charge injection and transport models, and energy transfer processes. Their applications in light emitting devices, solar cells, thin film transistors, photodetector and imaging photoreceptors, etc. are discussed. Aspects related to device fabrication and patterning may also be addressed.

New course description (for revision only): 

Meet Type(s): Lecture
Primary Meet Type: Lecture
Requisites: Add NE 479-T1 and NE 472 as anti-reqs
Special topics course: Yes ☐ No ☒
Cross-listed: Yes ☐ No ☒

Course Subject(s) to be cross-listed with and approval status:
Sections combined/held with:

Rationale for request:

ECE 634 used to be ECE 730-T18 and ECE 730-T18 was held with NE 479-T1 (soon to be renumbered to NE 472). This course was never added as an anti-req when the course numbers were changed and the discrepancy is causing issues with students “double dipping” in courses for credit.

Prepared by: Sarah Landy Date: 20-Mar-17