AGENDA ITEM NO: 10.2

UNIVERSITY COUNCIL

ACADEMIC PROGRAMS COMMITTEE
REQUEST FOR DECISION

PRESENTED BY: Len Proctor, Chair, Academic Programs Committee of Council

DATE OF MEETING: January 26, 2012

SUBJECT: **College of Engineering: Replacement programs for Bachelor of Science in Engineering in Electrical Engineering, Bachelor of Science in Engineering in Computer Engineering and Bachelor of Science in Engineering in Engineering Physics**

DECISION REQUESTED:

It is recommended:
That Council approve the replacement programs for Bachelor of Science in Engineering in Electrical Engineering, Bachelor of Science in Engineering in Computer Engineering and Bachelor of Science in Engineering in Engineering Physics, effective September 2012.

PURPOSE:
The Bachelor of Science in Engineering programs are academic programs at the University of Saskatchewan. Implementation of replacement programs requires approval by University Council.

SUMMARY:
The Academic Programs Committee discussed this proposed replacement program and program termination with Robert Johansson, Chary Rangacharyulu, Adam Bourassa and Rainer Dick. The purpose of these program changes is to provide an updated and more flexible program for students, reduce student and faculty loads, and to create a better program structure for accreditation.

New courses:

EP 214.3 Analog Signals and Systems
EP 313.3 Advanced Analog Electronics and Instrumentation
EP 325.3 Optical Systems Design
EP 417.3 Advanced Materials Science with Applications
PHYS 456.3 – Electricity and Magnetism II
EE 204.3 Basic Electronics and Electrical Power
EE 205.1 – Safety and Stewardship in Electrical and Computer Engineering
EE 241.3 – Introduction to Electric Power Systems
EE 265.3- Discrete-Time Signals and Systems
EE 365.3 – Algorithms and Circuits with Finite-Precision Arithmetics
EE 465.3 – Design of a DSP System

The Academic Programs Committee agreed that these were appropriate replacement programs for students and that students will benefit from the revised program. The revised programs will be effective for students beginning their second year in September, 2012.

ATTACHMENTS:
Program proposal documentation and related memos

Proposal for Curriculum Change
University of Saskatchewan

1. PROPOSAL IDENTIFICATION

Title of proposal:

Degree(s): Bachelor of Engineering in Engineering Physics

Field(s) of Study: Engineering Physics

Degree College: Engineering Department: Physics and Engineering Physics
Home College: Arts and Science

Contact person(s) (name, telephone, fax, e-mail):
Rainer Dick, 966-6443, rainer.dick@usask.ca (Acting Department Head)
Douglas Degenstein, 966-6447, doug.degenstein@usask.ca (EP Program Chair)
Adam Bourassa, 966-1418, adam.bourassa@usask.ca

Date: December 5, 2011

Approved by the degree college and/or home college:
The program revisions were approved by the degree college (Engineering).
The pertinent course changes for EP courses were approved by both colleges.
The pertinent course changes for PHYS courses were approved by the home college (Arts and Science), which is also the degree college for the Physics programs.

Proposed date of implementation: July 1, 2012
The revised Engineering Physics program will be phased in while the current version will be phased out in parallel.

2. Type of change

Requiring approval by Council

- ☐ Program revisions that will use new resources
- ☒ A replacement program, including program deletion
  (Please note that the revised program will be phased in while the current version is phased out.)

Proposal Document

Attach a proposal document, usually two or more pages, which covers the following information. The length and detail provided should reflect the scale or importance of the program or revision. Documents prepared for your college may be used.

3. RATIONALEE

This statement should include information about program objectives, need for the program, demand, uniqueness, student outcomes including employment or academic opportunities, and the expertise of the sponsoring unit. Please specify how this proposal relates to department/college plans and to Systematic Program Review or other review recommendations.

The objectives for the proposed revision of the Engineering Physics (EP) curriculum are twofold. First, we have tried to create a large amount of flexibility for students to take several electives throughout the course of the program. Secondly, by consolidating similar options in existing Engineering Physics (EP) and Electrical Engineering (EE) courses we have reduced the core teaching load required for EP program allowing us to allocate the freed resources toward the creation of new upper year EP elective courses. An important overall aspect of the revised program is that we are now in a strong and clear position for future ongoing accreditation of the EP degree.

Within the framework of the current second integrated plan, this will support in particular the commitment to improve the teacher-learner experience in the classroom by allowing EP and EE students to share more of their learning experience and gain a better perspective on the commonalities and differences between Engineering Physics and Electrical Engineering, and it will also be more rewarding for the course instructors to share their knowledge with both audiences. The program changes also foster collaboration between disciplines and Colleges. Furthermore, the student experience will be improved because the revised program contains four technical electives; this allows for far more choices for streams of electives and opens the possibility to consider the development of formal options. The core of the program, not including any of the electives, meets all national accreditation criteria. However, the additional requirement that two electives must have engineering science or engineering design components puts the program in very strong position for future accreditation.

Two teaching assignments are gained with the adoption of the program revisions allowing for the creation of new upper year technical electives without teaching resource implications. These will be created in the 2013-14 and 2014-15 academic years, as the years of the revised program are successively phased in.

Several aspects of the program have been strengthened through collaboration with existing EP and EE courses. The coverage of classical mechanics in the revised program has improved significantly through consolidation with two honours physics classes. The electronics and linear systems content has been enhanced through consolidation of five courses with EE. Additionally, the electro-magnetic theory in the revised program improved significantly, including a complete coverage of the Griffiths foundational textbook, and the material science in the revised program has improved immensely with the addition of a core class in advanced materials topics. Optical systems design, which is a topic that has been identified as a particularly desired skill by industry, is now covered in a complete course improving the overall optics content in the program.

In terms of accreditation, the Natural Science Accreditation Units are covered purely by PHYS classes and the Engineering Science Accreditation Units are covered purely by EP classes. In the past several courses contained both types of Accreditation Units and this was an issue that had to be justified. The clarity of division in the revised program will make this easily justified for future accreditations.

4. DESCRIPTION OF PROGRAM CHARACTERISTICS

Please include a complete draft Calendar entry.
In particular, please indicate if a template is already in place for such a program (for example, if it follows the general requirements and standards of B.Sc. programs) or if new standards are being introduced for this program.

When existing courses are listed, please include the course title as well as the course number.

Engineering Physics Curriculum- For students entering second year in the EP program in 2012 or later

Year 2 (37 credit units)
Term 1
CMPT 116.3
EE 202.3
EE 221.3
EP 253.1
MATH 223.3
PHYS 252.3
RCM 300.3

Term 2
EP 214.3
EP 228.3
EE 232.3
MATH 224.3
PHYS 223.3
STAT 241.3

Year 3 (40 credit units)
Term 1
EP 271.3
EP 313.3
EP 353.2
PHYS 356.3
PHYS 383.3
PHYS 402.3
3 credit units of requirements

Term 2
EP 317.3
EP 320.3
EP 354.2
EP 325.3
PHYS 323.3
PHYS 371.3
3 credit units of requirements

Year 4 (36 credit units)
Term 1
EP 413.3
EP 417.3
GE 348.3
PHYS 456.3
3 credit units of requirements

Term 2
EP 421.3
GE 449.3
9 credit units of requirements

Term 1 and Term 2
EP 495.6
PHYS 490.0

Requirements

6 credit units of Senior Engineering Requirement

- 6 credit units from Engineering Electives. In total at least 3 credit units ***must*** be at 400 level.

Engineering Science or Engineering Design List:
EP 464.3 Advanced Applied Electromagnetism
CME 342.3 VLSI Circuit Design
EE 241.3 Introduction to Power Systems
EE 341.3 Electric Machines Fundamentals
EE 342.3 Transmission of Electrical Energy
EE 442.3 Power Systems Operation and Control
EE 443.3 Power Electronics
EE 471.3 Introduction to Micro and Nanotechnology
EE 472.3 Optoelectronics and Photonics
GE 213: Mechanics of Materials
GEOE 377: Introduction to Mining and Mineral Processing Engineering
CE 317: Structural Analysis
ENVE 201: Principles of Environmental Engineering
Or an approved elective

6 credit units Senior Science Requirement

- 6 credit units from Engineering Electives or CMPT, CHEM, GEOL courses at 200 level or higher or PHYS, ASTR, MATH, STAT courses at 300 level or higher. In total at least 3 credit units ***must*** be at 400 level.

3 credit units Complementary Studies Requirement
3 credit units Senior Humanities or Social Science Requirement

5. RESOURCES

Please describe what resources will be required by the new or revised program. Include information about the impact this proposal will have on resources used by existing programs. Please indicate whether the program be handled within the existing resources of the department or college (eg, faculty, secretarial support, equipment, information technology, laboratories, library resources, space, etc). If new resources will be needed, please describe how these will be found. Include any required memos from the Dean or department heads regarding resources.

We will be able to offer the revised program with the resources which are available for the current version of the Engineering Physics program.

The following new courses will go through University Course Challenge from Arts and Science:

EP 214.3 Analog Signals and Systems (first offered in 2012-2013)
EP 313.3 Advanced Analog Electronics and Instrumentation (first offered in 2013-2014)
EP 325.3 Optical Systems Design (first offered in 2013-2014)
EP 417.3 Advanced Materials Science with Applications (first offered in 2014-2015)
PHYS 456.3 Electricity and Magnetism II (first offered in 2014-2015)

The following courses are slated for deletion as a consequence of the program revision:

EP 225.3 (not offered any more in 2012-2013)
EP 229.3 (not offered any more in 2012-2013)
PHYS 251.3 (not offered any more in 2012-2013)
EP 311.3 (last offered in 2012-2013)
EP 321.3 (last offered in 2012-2013)
EP 324.3 (last offered in 2012-2013)
PHYS 381.3 (last offered in 2012-2013)
EP 414.3 (last offered in 2013-2014)

Deletion of EP 225, EP 229 and PHYS 251 has been submitted through Arts and Science already, while the remaining courses will be deleted in the year of their last offering to ensure smooth phasing out of the old program.

The following existing courses are relabeled (as approved by Arts and Science):
PHYS 253.1 to EP 253.1, PHYS 353.2 to EP 353.2, PHYS 354.2 to EP 354.2.

6. RELATIONSHIPS AND IMPACT OF IMPLEMENTATION

Please describe the impact this program will have on department activities and on students, and on other departments or colleges. Describe the consultation process followed for this program, including any memos received.

We had extensive consultations with the Department of Electrical Engineering to make this collaboration between the Engineering Physics program and the programs in Electrical and Computer Engineering work. The only anticipated impact of this program change and the corresponding program changes in Electrical Engineering is an improvement of attractiveness of the revised programs, while at the same time we will make better use of our teaching resources.

The consultations with Electrical Engineering resulted in an MoA for cross listing of courses. However, with advice from APC we meanwhile abstained from the idea of cross listing, i.e. all the courses used in both programs will have either an EP or an EE label. The following courses will be used in both programs: EE 202.3, EE 221.3, EE 232.3; EP 214.3, EP 313.3.

7. BUDGET

Please indicate if budget allocations within the department or the college will change due to this program. Consult with the College's Financial Analyst (Financial Services Division) and submit the Budget Consultation form if allocations are required.

No change in budget allocations is anticipated as a consequence of this program revision.

New courses for the Engineering Physics Program

EP 214.3 Analog Signals and Systems 2(3L-2P)
Prerequisites: PHYS 155
Prerequisite or Corequisite: MATH 224
Introduces the mathematical techniques for determining the behavior of analog systems. Topics include complex numbers and functions, first and second order differential equations for modeling electrical and mechanical systems, the Laplace transform, solutions for initial conditions, solutions for a step input, general transient response, the frequency response, Bode plots, s-plane analysis and stability, one and two pole filters, the Fourier transform.
Note: Students who have credit for EE 214 may not take this course for credit.

EP 313.3 Advanced Analog Electronics and Instrumentation 1(3L-3P)
Prerequisite: EP 214, EE 221, EE 232
Covers the analysis and design of circuitry used in modern instruments. Topics include frequency response and the role of feedback in electronic circuits, differential and multistage MOS and BJT amplifiers, real opeRationale amplifier characteristics, instrumentation amplifiers, active filters, oscillators, waveform generation circuits and power supplies. Transducers, noise and noise reductions techniques, and measurement theory and standards are also covered, along with analog and digital interfacing circuits.

EP 325.3 Optical Systems Design 2(3L-3P) FIRST OFFERED 2013-14
Prerequisite: EE 202 or PHYS 230
This class provides the foundation of geometrical optics for the understanding of complex optics in optical instruments. Topics include image formation, curved optical surfaces, thin and thick lenses, cardinal points and Gaussian optics, apertures, paraxial ray tracing, matrix methods, Fermat's principle and third-order aberrations. Classical instrumentation design is studied including Newtonian and Cassegrain telescopes, astronomical cameras and compound systems. The class concludes with an introduction to ray tracing methods with software packages and techniques for design with realistic computationally difficult problems.

EP 417.3 Advanced Materials Science with Applications 1(3L)
FIRST OFFERED 2014-15
Prerequisite: EP 317, PHYS 356, PHYS 383
This course is designed to provide students with a fundamental understanding of physical properties of solid state materials and their device applications and includes quantum effects in transistor technology, applications of magnetic materials, surface kinetics, thin films and synthesis and processing of materials.

PHYS 456.3 – Electricity and Magnetism II 1(3L) FIRST OFFERED 2014-15
Prerequisites: PHYS 356.3
This course provides an advanced treatment of electromagnetic waves in matter, electromagnetic radiation, and relativistic electrodynamics.

Proposal for Curriculum Change
University of Saskatchewan

1. PROPOSAL IDENTIFICATION

Title of proposal:

Degree(s): Bachelor of Engineering in Electrical Engineering
and Bachelor of Engineering in Computer Engineering

Field(s) of Study: Electrical Engineering or Computer Engineering

Level(s) of Study: Option(s):

Degree College: Engineering Department: Electrical and Computer Engineering
Home College: Engineering

Contact person(s) (name, telephone, fax, e-mail):
Brian Daku, head, Department of Electrical and Computer Engineering
tel: 5421 fax: 5407 email: Brian Daku <bld788@mail.usask.ca>

Date: December 7, 2011, revisions January 13, 2012

Approved by the degree college and/or home college: Approved at a meeting of the Academic Program and Standards Committee of the College of Engineering on October 19, 2011 with additional changes approved on November 23, 2011and January 13, 2012

Proposed date of implementation: For students entering second year in 2012-13

2. Type of change

Requiring approval by Council

- ❑ Program revisions that will use new resources
- ❑ A replacement program, including program deletion

Proposal Document

Attach a proposal document, usually two or more pages, which covers the following information. The length and detail provided should reflect the scale or importance of the program or revision. Documents prepared for your college may be used.

3. RATIONALEE

This statement should include information about program objectives, need for the program, demand, uniqueness, student outcomes including employment or academic opportunities, and the expertise of the sponsoring unit. Please specify how this proposal relates to department/college plans and to Systematic Program Review or other review recommendations.

It has been over ten years since the last major revision of the Electrical Engineering program. Most of the minor revisions to the program since then have been reactionary mainly to changes in the requirements for accreditation. Given the rapid advances in various fields of Electrical Engineering over the past decade, a reassessment of the courses and program is appropriate. Although the Computer Engineering program is relatively new, the other goals of the program revision listed below apply to that
program as well.

In redesigning the programs, we attempted to meet certain objectives.

Reduce student load: As long as the engineering profession considers the B.E. to be the defining degree for an engineer, we feel obligated to put on a program in which average students, who diligently apply themselves, can complete in four years. Such is not the case with our current program; too many of our students take five years to obtain their degree. Our current program has either six or seven courses in each term of second, third, and fourth years; our goal was to reduce this number to five. However, it proved too difficult to meet the requirements of accreditation. We have managed to reduce the number to either five or six courses per term with a net reduction of five courses.

Reduce faculty load: Always a good thing! In our current program a large faculty effort (equivalent to 15 lecture courses) went into running our laboratory courses; these have been eliminated and more reliance will be put on our technical staff to operate the labs. Six courses have had their content aligned with courses in the program for Engineering
Physics; these courses will be co-taught saving three course loads for each department. Create more depth to the programs: The legacy of alternating year electives is a group of technical electives that are effectively third year courses. Few of our courses build on third year to cover advanced material. To create the opportunity for more depth, focus areas have been created which eliminates technical electives; there are three focus areas for each program with one area common to both programs. Focus areas allow us to create a set of courses that advance term by term leading to more advanced courses than is currently possible.

Create more breadth to the programs: This goal is impossible while reducing student load. However, breadth is maintained to a certain degree by requiring students to complete two of the three focus areas.

Control laboratory and project hours: In the design of our current programs, laboratory exercises were concentrated in laboratory courses. Over the years, several instructors have added laboratory projects or experiments to their lecture courses without consideration for work required of the students in their other classes with the result that students can be overloaded. To regain control, all laboratory exercises and projects become part of the lecture courses with prescribed amounts of time scheduled through the lab coordinator.

Create a better program structure for accreditation: One problem of our current programs is that our technical electives form one large pool. During accreditation, we lose significant credit for content because of the so-called minimum path analysis. By creating focus areas in place of the elective pool, we will maximize our accreditation numbers. Also the administrative structure with a manager for each focus area will position us to make the transition to outcome based accreditation assessment.

4. DESCRIPTION OF PROGRAM CHARACTERISTICS

Please include a complete draft Calendar entry.
In particular, please indicate if a template is already in place for such a program (for example, if it follows the general requirements and standards of B.Sc. programs) or if new standards are being introduced for this program.

When existing courses are listed, please include the course title as well as the course number.

Electrical Engineering Curriculum- For students entering second year of Electrical Engineering in 2012 or later

Year 2 (33 credit units)
Term 1
CMPT 116.3
EE 202.3
EE 221.3
EE 265.3
MATH 223.3

Term 2
EE216.3
EE 241.3
EE 232.3
EE 271.3
EP 214.3
MATH 224.3

Year 3 (34 credit units)
Focus Areas – Students must complete <u>two focus areas</u> from Power and Energy; Digital Signal Processing and Applications; or Sensors, Circuits and Devices.

Term 1
CME 331.3
GE 348.3
6 credit units First Focus Area
6 credit units Second Focus Area

Term 2
EE 205.1
EE 481.3
RCM 300.3
3 credit units First Focus Area
3 credit units Second Focus Area
3 credit units Natural Science Elective List 1 or List 2

Year 4 (33 credit units)
Focus Areas – – Students must complete two focus areas from Power and Energy; Digital Signal Processing and Applications; Sensors, Circuits and Devices.

Term 1
6 credit units First Focus Area
6 credit units Second Focus Area
3 credit units Senior Humanities/Social Elective

Term 2
GE 449.3
3 credit units Complementary Studies Elective
3 credit units First Focus Area
3 credit units Second Focus Area

Term 1 and Term 2
EE 495.6

Focus Areas – Students must complete two focus areas from Power and Energy; Digital Signal Processing and Applications; Sensors, Circuits and Devices.

Power and Energy
Year 3
Term 1 - EE 341.3, EE 342.3
Term 2 - EE 441.3

Year 4
Term 1 – EE 442.3, EE 443.3
Term 2 – EE 444.3

Digital Signal Processing and Applications
Year 3
Term 1 – EE 362.3, CME 341.3
Term 2 -- EE 365.3

Year 4
Term 1 – EE 461.3, EE 456.3
Term 2 – EE 465.3

Sensors, Circuits and Devices
Year 3
Term 1 – EE 301.3, EP 313.3
Term 2 - EE 402.3

Year 4
Term 1 – EE 372.3, EE 471.3
Term 2 – EE 472.3

Computer Engineering Curriculum- For students entering second year of Computer Engineering in 2012 or later

Year 2 (33 credit units)
Term 1
CMPT 116.3

EE 202.3
EE 221.3
EE 265.3
MATH 223.3

Term 2
CMPT 117.3
EE216.3
EE 232.3
EE 271.3
EP 214.3
MATH 224.3

Year 3 (31 credit units)
Focus Areas – Students must complete the Digital Systems Focus Area and *one of the* Digital Signal Processing and Applications Focus Area or Computer Software Focus Area.

Term 1
CME 331.3
CME 341.3
CMPT 214.3
3 credit units Digital Systems Focus Area
3 credit units Second Focus Area

Term 2
EE 205.1
GE 348.3
RCM 300.3
3 credit units Digital Systems Focus Area
3 credit units Second Focus Area
3 credit units Natural Science Elective List 1 or List 2

Year 4 (33 credit units)
Term 1
6 credit units Digital Systems Focus Area
6 credit units Second Focus Area
3 credit units Senior Humanities/Social Elective

Term 2
GE 449.3
3 credit units Complementary Studies Elective
3 credit units Digital Systems Focus Area
3 credit units Second Focus Area

Term 1 and Term 2
CME 495.6

Focus Areas – Students must complete Digital Systems Focus Area and *one of the* Digital Signal Processing and Applications Focus Area or Computer Software Focus Area.

Digital Systems Focus Area
<u>Year 3</u>
Term 1 – CME 342.3
Term 2 - CME 332.3

Year 4
Term 1 – CME 433.3, CME 435.3
Term 2 – CME 451.3

Digital Signal Processing and Applications Focus Area
Year 3
Term 1 – EE 362.3
Term 2 - EE 365.3

Year 4
Term 1 – EE 461.3, EE 456.3
Term 2 – EE 465.3

Computer Software Focus Area
Year 3
Term 1 – CME 270.3
Term 2 - CMPT 280.3

Year 4
Term 1 – 6 credit units Group B Elective
Term 2 – 3 credit units Group C Elective

Group B Electives – CMPT 332.3, CMPT 350.3, CMPT 370.3
Group C Electives – CMPT 432.3, CMPT 434.3

5. RESOURCES

Please describe what resources will be required by the new or revised program. Include information about the impact this proposal will have on resources used by existing programs. Please indicate whether the program be handled within the existing resources of the department or college (eg, faculty, secretarial support, equipment, information technology, laboratories, library resources, space, etc). If new resources will be needed, please describe how these will be found. Include any required memos from the Dean or department heads regarding resources.

Teaching resources:
Fewer instructor hours will be required to implement the revised programs. The reduction is possible because the following lecture classes will be deleted: EE216, EE352, EE395, EE445, and CME462. The reduction is partly offset by two new courses; EE365 and EE465. Certain other courses are being replaced with revised versions, but this change will not affect resource requirements.

Instructor hours will also be saved by co-teaching five courses with the department of Physics and Engineering Physics. The Engineering Physics program is being revised, and we took this opportunity to align courses in with similar content in the EP, EE and CME programs. The five courses are EP214, EE221, EE232, EE202, and EP313. As the designations indicate, two will be taught by Physics and three will be taught by our department.

The laboratory program is changing significantly which will reduce the teaching load on faculty while increasing the load on our technical staff and TAs. The three current laboratory classes (EE292, EE391, and EE392) will be deleted; the laboratory classes are taught by faculty instructors and consume the equivalent teaching resources of about 15 lecture courses. The laboratory content will be assigned to appropriate lecture classes, but we envision that day-to-day laboratory supervision will be handled mostly by our technical staff and TAs. Course instructors will be

responsible for introducing background material for each laboratory exercise into the lectures. In anticipation of using technical staff to supervise the laboratories, two years ago, during our last search to fill an open technical position, we hired a person with professional engineering qualifications. Also the position was shifted from CUPE to ASPA to allow greater scope for teaching activities. The person hired has worked out well, and we likely will do the same for the next open technical position. To supplement the technical staff, TAs will help in the laboratory and share the burden of marking. TAs essentially do that now in our laboratory courses, but they are somewhat superfluous because of the presence of faculty. In the revised programs, TAs will have greater responsibility for supervision. Some extra TAs will likely be needed, funds for which will come out of the departmental budget.

Equipment:
We anticipate that new or revised laboratory exercies will be part of the revised program. One reason for moving laboratory content into lecture courses is to give the instructors incentive to modernize the experiments and projects. New equipment will likely be required which we have already begun to acquire. The purchases will be made from funds we normally obtain from the engineering advancement trust.

We do not believe the revised programs will require any other resources.

6. RELATIONSHIPS AND IMPACT OF IMPLEMENTATION

Please describe the impact this program will have on department activities and on students, and on other departments or colleges. Describe the consultation process followed for this program, including any memos received.

Certain courses in the revised programs will be taught by the Math and Computer Science departments, and the Physics department. The first two departments teach courses in the current programs and the situation does not change. All departments have been consulted, and we have had extensive discussions with Physics and Computer Science.

7. BUDGET

Please indicate if budget allocations within the department or the college will change due to this program. Consult with the College's Financial Analyst (Financial Services Division) and submit the Budget Consultation form if allocations are required.

No substantial changes to budgets are anticipated in implementing the revised programs.

List of new and revised EE courses:

i) *Change of Calendar Designation, Subject Designation, Title, Prerequisite and Course Description*

From: EE 214.3 System Modeling and Network Analysis 2(3L)
Prerequisites: MATH 123 and MATH 124 and EE 201
Deriving differential equations for electrical and mechanical systems, solving differential equations for initial conditions and a step input, the Laplace transform, Second Order Systems, solving transient response by the Laplace transform, Simulation with Matlab/Simulink, Frequency Response, Passive Filters, Network Synthesis, Two- Port Networks.

To: ***EP 214.3 Analog Signals and Systems 2(3L-2P)***
Prerequisites: MATH 123 and MATH 124 and PHYS 155
Prerequisite or Corequisite: MATH 224
Introduces the mathematical techniques for determining the behavior of analog systems. Topics include complex numbers and functions, first and second order differential equations for modeling electrical and mechanical systems, the Laplace transform, solutions for initial conditions, solutions for a step input, general transient response, the frequency response, Bode plots, s-plane analysis and stability, one and two pole filters, the Fourier transform.
Note: Students who have credit for EE 214 may not take this course for credit.

Rationale: The course will be taught by Physics and Engineering Physics and should have an EP designation. The new name better reflects the course content. As part of the proposed changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EP214 will have two hours of laboratory each week. The new description more accurately reflects the future content of the course. The material in PHYS155 is sufficient for EP214. However, differential equations from MATH224 are helpful.

ii) *Change of Calendar Designation and Course Description*

From: EE 472.3 Optoelectronics and Photonics 1(3L)
Topics include physical optics, dielectric planar waveguides, optical fibers in optical communications, dispersion, bit-rate and bandwidth, semiconductor device principles, degenerate semiconductors, heterojunctions, light emitting devices, stimulated emission,
Einstein coefficients for lasing devices, gas lasers, semiconductor lasers, new solid state lasers, emitters for optical communications, photodetectors, photodetectors for optical communications, photovoltaics, light modulation.

To: ***EE 472.3 Optoelectronics and Photonics 1(3L-2P)***
FIRST OFFERED 2014-15
Topics include physical optics, Gaussian beams, thin film optics, Fabry-Perot resonators, diffraction, dielectric planar waveguides, optical fibers in optical communications, dispersion, bit-rate and bandwidth, direct and indirect semiconductors, E-k diagrams, semiconductor device principles, heterojunctions, light emitting devices, stimulated emission, Einstein coefficients for lasing devices, gas lasers, semiconductor lasers, new solid state lasers, emitters for optical communications, photodetectors, heterojunction photodiodes, noise in detectors, photodetectors for optical communications, polarization, Fresnel's

ellipsoid, birefringence, light modulation, nonlinear effects, Pockels effect and modulators.

Rationale: As part of the proposed changes to the B.E. program in Electrical Engineering, a laboratory is being made part of lecture courses. EE472 will have three hours of laboratory approximately every other week. As part of the proposed new B.E. program in Electrical Engineering, some redundancy has been removed in classes taught within a stream, opening up time for more advanced topics. Also, some topics have been updated according to advancement of technologies
(e.g. in optical fibers).

iii) *Change of Calendar Designation and Term*

From: EE 471.3 Introduction to Micro and Nanotechnology 2(3L)

To: ***EE 471.3 Introduction to Micro and Nanotechnology 1(3L-2P)***
FIRST OFFERED 2014-15

Rationale: As part of the change to the B.E. program in Electrical Engineering, six classes within each stream need to be arranged over 2 years, 4 classes in terms 1 and 2 classes in terms 2. The sequence of material to be taught as well as balancing the laboratory load for students throughout the terms benefits from this class being offered in term 1. As part of the changes to the B.E. program in Electrical Engineering, a laboratory is being made part of lecture courses. EE 471 will have three hours of laboratory approximately every other week.

iv) *Change Calendar Designation, Course Description, Prerequisite and Title*

From: EE 461.3 Digital Signal Processing II 1(3L-1P)
Prerequisites: EE 362
Covers numerically controlled oscillators, architecture of digital filters, finite impulse response linear phase filters, filter design using windows, infinite impulse response filters, discrete Fourier transform (DFT) and fast Fourier transform (FFT), and effects of finite register lengths on filter performance.

To: ***EE 461.3 Digital Filter Design 1(3L-1.5P)***
Prerequisites: EE 365
FIRST OFFERED 2014-15
This course covers several techniques for designing and implementing digital filters with the primary objective of minimizing the number of multipliers used in the filters. The course gives insight into the effects of finite word length arithmetic on the performance of filters.

Rationale: The new name better reflects the updated content of EE461. As part of the changes to the B.E. programs in Electrical Engineering and Computer Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE461 will have three hours of laboratory every other week. The new description more accurately reflects the content of the updated course. Some material in EE362 in the current program is revised and reorganized into EE365 in the revised program.

v) *Change Calendar Designation, Course Description and Prerequisite*

From: EE 456.3 Digital Communications 1(3L)
Prerequisites: EE 362

Examines the transmission of information (voice, video or data) over a noisy channel and presents the ideas and techniques fundamental to digital communication systems. Emphasis is placed on system design goals and the need for trade-offs among basic system parameters such as signal-to-noise ratio, probability of error, and bandwidth expenditure. Topics include binary baseband/passband data transmission, M-ary modulation techniques (QPSK, OQPSK, MSK, M-ASK, M-PSK, M-QAM and MFSK), signaling over band-limited channels and methods to deal with ISI, and signaling over channels with amplitude and phase uncertainties.

To: ***EE 456.3 Digital Communications 1(3L-1.5P)***
Prerequisites: EE 365
FIRST OFFERED 2014-15
Examines the transmission of information (voice, video or data) over a noisy channel and presents the ideas and techniques fundamental to digital communication systems. Emphasis is placed on system design goals and the need for trade-offs among basic 2 system parameters such as signal-to-noise ratio, probability of error, and bandwidth expenditure. Topics include binary baseband/passband data transmission, M-ary modulation techniques (QPSK, OQPSK, MSK, M-ASK, M-PSK, M-QAM and MFSK), signaling over band-limited channels and methods to deal with ISI, and signaling over channels with amplitude and phase uncertainties.

Rationale: As part of the changes to the B.E. programs in Electrical Engineering and Computer Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE456 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course as it is currently taught. Some material in EE362 in the current program is revised and reorganized into EE365
in the revised program.

vi) *Changes to Calendar Designation, Description, Term and Title*

From: EE 444.3 Electric Machines II 1 (3L)
Prerequisite: EE 341
Provides an in-depth analysis of electric machines and the dynamic behavior of electric machines. Topics include inrush current, synchronous machine transients, single-phase induction motors, induction generators, brushless motors, variable reluctance and **2** stepping motors, power electronic drives for speed and torque control of machines, DC machine and synchronous generator dynamics.

To: ***EE 444.3 Advanced Electric Machinery and Drive Systems 2(3L-1.5P)***
Prerequisite: EE 341
Prerequisites or Corequisites: EE 443 and EE 481
FIRST OFFERED 2014-15
This course provides an in-depth analysis of electric machines, the drive systems and the dynamic behavior of electric machines. Topics include inrush current, current and voltage transformer errors, dc saturation, synchronous machine capability curves, effect of salient poles, wind power generation (induction generators, doubly fed induction generators, simulation models, design of control systems for stability), variable reluctance and stepping motors, power electronic drives for speed and torque control of machines, transients and dynamics of AC machines.

Rationale: The new name better reflects the course content. The course needs to be offered in term 2 since the prerequisite for the course is to be offered in term 1. As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE444 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course. Material covered in EE443 and E481 is now useful for EE444.

vii) *Changes to Calendar Designation, Course Description and Prerequisite*

From: EE 443.3 Power Electronics 2(3L)
Prerequisite: EE 221
Prerequisite or Corequisite: EE 341
Introduction to switching devices: volt-ampere characteristics of BJTs, thyristors,GTOs, IGBT and MOSFETS, switching losses. Average, rms and peak current and voltage ratings of power electronic devices. Commutation of power electronic devices; analyses of uncontrolled and controlled converter circuits, single-phase and three-phase AC-DC converters, DC drives. Principle of DC to DC conversion: analyses of boost and buck choppers. Principle of DC to AC conversion, application of inverters, analysis of inverter circuits, voltage control in inverter circuits, reduction of output harmonics in inverters. Snubber circuits. Emphasis will be placed, throughout the course, on theutilization of software application packages.

To: ***EE 443.3 Power Electronics 2(3L-1.5P)***
Prerequisite: EE 221
FIRST OFFERED 2014-15
This course discusses the fundamental concepts and introduces the essentials of analyses and design of power electronic circuits. Topics include power electronics 2 devices, switching losses, analyses and design of single-phase ac-dc converters, analyses and design of three-phase ac-dc converters, analyses and design of dc-dc converters, analyses and design of single- and three-phase dc-ac converters.

Rationale: As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE443 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course. All machines related material has been removed from EE443. Therefore, students no longer need the basics of machines from EE341.

*viii)*Changes to Calendar Description, Course Description and Prerequisites

From: EE 442.3 Power Systems Operation and Control 2(3L)
Prerequisite: EE342
Prerequisite or Corequisite: EE341
Covers economic dispatch, the lossless case, inequality constraints, consideration of transmission losses, unit commitment, system control, control loops, the automatic voltage regulator, automatic load frequency control, system protection, subsystems and attributes, zones of protection, transducers, relay design, protection of lines, transformers, generators and busbars, and microprocessor based relays.

To: ***EE 442.3 Power Systems Operation and Control 2(3L-1.5P)***
Prerequisites or Corequisites: EE 441 and EE 481

FIRST OFFERED 2014-15
Covers economic dispatch: the lossless case, inequality constraints, participation factors, consideration of transmission system effects, penalty factors, and unit commitment; power system control: the control loops, the automatic voltage regulator, automatic load frequency control; and power system protection: subsystems and 2 attributes, zones of protection, protection of lines, protection of transformers and machines.

Rationale: As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE442 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course. Material covered in EE441 and E481 is now necessary for EE444.

ix) *Changes to Calendar Designation, Title and Course Description*

From: EE 441.3 Power Systems II 1(3L)
This course covers network calculations; loop and nodal equations; bus impedance and admittance matrices; network equations in matrix form; computer storage; load flow studies; analysis of faulted power systems; ymmetrical omponents; sequence networks; balanced and unbalanced faults; power system stability; swing equation; equal area criterion; and numerical solution of swing equation.

To: ***EE 441.3 Power System Analysis 1(3L-1.5P)***
FIRST OFFERED 2014-15
This course covers in depth main topics: 1-Analysis of faulted power systems which includes bus impedance and admittance matrices; network equations in matrix form; symmetrical components; sequence networks; balanced and unbalanced faults, 2- Load flow studies; the static load flow equations, classification of system buses, Gauss-Seidel and Newton-Raphson methods, 3- Power system stability; modeling of the synchronous machine during transients; swing equation; equal area criterion; digital computer solution of the swing equations; small signal stability, 4- Smart grid.

Rationale: The new name better reflects the course content. As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE441 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course.

x) Changes to Calendar Designation

From: EE 402.3 Microwave and RF Circuits 1(3L)
To: ***EE 402.3 Microwave and RF Circuits 1(3L-2.5P)***
FIRST OFFERED 2013-14

Rationale: As part of the changes to the B.E. program in Electrical Engineering, a laboratory is being made part of lecture courses. EE402 will have three hours of laboratory approximately every week.

xi) Changes to Calendar Designation

From: EE 372.3 Electronic Devices 1(3L)

To: EE 372.3 Electronic Devices 1(3L-0.5P) FIRST OFFERED 2014-15

Rationale: As part of the changes to the B.E. program in Electrical Engineering, a laboratory is being made part of lecture courses. EE372 will have three hours of laboratory twice in the term.

xii) *Changes to Calendar Designation, Course Description, Prerequisite and Title*

From: *EE 342.3 Power Systems I* 1(3L)
Prerequisite: EE 212
This course covers generation of energy, components of a modern power system, threephase systems; voltage, current and power calculations, per-unit system, modelling of transformers, single-line diagrams, Inductance and capacitance calculations of single and three-phase lines, transmission lines; modeling, steady-state operation and compensation, power system controls; local and central controls.

To: EE 342.3 Transmission of Electrical Energy 1(3L-1.5P)
Prerequisite: EE 241
FIRST OFFERED 2013-14
This course introduces the components of a modern power system; series impedance and shunt admittance calculations of single- and three-phase transmission lines; current and voltage relations on a transmission lines; transmission lines modeling and steady state operation; transmission line series and shunt compensations; per-unit system and single-line diagrams; corona; transmission line transients.

Rationale: The new name better reflects the course content. As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE342 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course. EE 212 (Passive AC Circuits) is being replaced by EE 241 (Introduction to Electric Power Systems).

xiii) *Changes to the Calendar Designation, Course Description, Prerequisite , Title and Term*

From: EE 341.3 Electric Machines I 2(3L)
Prerequisite: EE 212
Covers the steady-state theory of electric machines. Topics include transformers (equivalent circuit, three-phase transformers), synchronous machines (equivalent circuit, operating characteristics, starting of synchronous motors), three-phase induction motors (equivalent circuit, torque-speed curve, efficiency calculations, starting methods), and DC machines (armature windings, commutation, armature reaction, shunt and series DC machines)

To: EE 341.3 Electric Machines Fundamentals 1(3L-1.5P)
Prerequisite: EE 241
FIRST OFFERED 2013-14
Covers the steady-state theory of electric machines. Topics include induction machines-equivalent circuit, efficiency, operating characteristics, starting, speed control and induction generator principle; synchronous machines-equivalent circuit, efficiency, operating characteristics, motor characteristics and

speed control; DC machines operation, efficiency, shunt and series machines, speed control, starting.

Rationale: The new name better reflects the course content. The course needs to be offered in term 1 since it is a prerequisite for a course to be offered in term 2. As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE341 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course. EE 212 (Passive AC Circuits) is being replaced by EE 241 (Introduction to Electric Power Systems).

xiv) *Changes to Calendar Designation, Subject Designation, Course Description and Prerequisite*

From: EE 323.3 Electronic Instrumentation 1(3L)
Prerequisites: EE 221 and EE 232
Topics include opeRationale amplifier circuits such as instrumentation amplifiers and waveform generation circuits, passive and active filter design, transducers, noise sources and noise reduction techniques, analog and digital interfacing such as A/D converters, D/A converters, sample and hold circuits, and digital instrumentation buses.

To: EP 313.3 Advanced Analog Electronics and Instrumentation 1(3L-3P)
Prerequisites: EP 214 and EE 221 and EE 232
FIRST OFFERED 2013-14
Covers the analysis and design of circuitry used in modern instruments. Topics include frequency response and the role of feedback in electronic circuits, differential and multistage MOS and BJT amplifiers, real ope Rationale amplifier characteristics, instrumentation amplifiers, active filters, oscillators, waveform generation circuits and power supplies. Transducers, noise and noise reductions techniques, and measurement theory and standards are also covered, along with analog and digital interfacing circuits.

Rationale: As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EP313 will have three hours of laboratory each week. The new description more accurately reflects the content of the course as it is currently taught. The material on s-plane, pole-zero theory, and second order filters introduced in EP214 is used in EP313.

xv) *Changes to Calendar Designation*

From: EE 232.3 Digital Electronics 2(3L)
To: EE 232.3 Digital Electronics 2(3L-2P)
Rationale: As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE232 will have two hours of laboratory every week.

xvi) *Changes to Calendar Designation and Prerequisite*

From: EE 221.3 Analog Electronics 1(3L-.5P)
Prerequisite or Corequisite: EE 201
To: EE 221.3 Analog Electronics 1(3L-1.5P)
Prerequisite: PHYS 155

Rationale: As part of the changes to the B.E. program in Electrical Engineering, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE221 will have three hours of laboratory EE201 is being redesigned and will have less relevant material for EE221. The Material in PHYS155 is sufficient for EE221.

xvii) *NEW Course EE 204.3*

NEW course EE 204.3 Basic Electronics and Electrical Power as described in the new course proposal form
Rationale: EE204 is designed as a service course covering topics in electrical engineering required in the programs for mechanical and chemical engineering. This material was formerly given in EE201; however, changes to EE201 render that course less suitable for this purpose.

xviii) *Change Prerequisites*

From: EE 221.3 Analog Electronics
Prerequisite(s) or Corequisite(s): EE 201
To: ***EE 221.3 Analog Electronics***
Prerequisite(s) or Corequisite(s): EE 202
Rationale: EE201 is being replaced with EE202.

From: EE 301.3 Electricity Magnetism and Fields
Prerequisite(s): EE 201 (or EP 229) and MATH 223 and MATH 224
To: ***EE 301.3 Electricity Magnetism and Fields (Effective 2013-14)***
Prerequisite(s): EE 202 and MATH 223 and MATH 224
Rationale: EE201 and EP229 are being replaced with EE202.

From: EE 372.3 Electronic Devices
Prerequisite(s): EE 201 and EE 271
To: ***EE 372.3 Electronic Devices (Effective 2013-14)***
Prerequisite(s): EE 202 and EE 271
Rationale: EE201 is being replaced with EE202

From: EE 481.3 Control Systems
Prerequisite(s): EE 351 or (EP 320 and MATH 338)
To: ***EE 481.3 Control Systems***
Prerequisite(s): EP 214 and EE 265 (or EE 351)
Rationale: EE351 is being replaced with EP214 and EE265.

xix) *Change Course Title, Designation, Description and Prerequisite*

From: EE 362.3 Digital Signal Processing I 2(3L-1P)
Prerequisite(s): EE 351
Representation and analysis of discrete-time signals and systems using difference equations, the Discrete-Time Fourier Transform, and the z-transform. Assignment topics **2** include: properties of signals and systems, eigenfunctions of LTI systems, convolution,

pole-zero plots, sampling in time and frequency domains, basic digital filters, multirate techniques and polyphase implementations.

To: ***EE 362.3 Digital Signal Processing 1(3L-1P)***
Prerequisite(s): EP 214.3 and EE 265
(First Offered 2013-14)
This course covers the basic theory of discrete-time signal processing with linear time invariant (LTI) systems. The systems are primarily analyzed in the frequency domain, which means emphasis is placed on the z-Transform of discrete-time signal as well as the system function for and frequency response of discrete-time systems.

Rationale: As part of the proposed changes to the B.E. programs in Electrical Engineering and Computer Engineering, the name of EE461, the follow on course to EE362, will be changed from *Digital Signal Processing II* to *Digital Filter Design* to reflect its updated content. As such, there is no need to have the *I* in the name of EE362. As part of the proposed changes to the B.E. programs in Electrical Engineering and Computer Engineering, the course needs to be offered in term 1. As well, the laboratory content which was part of laboratory courses in the current program is being made part of lecture courses. EE362 will have three hours of laboratory every other week. The new description more accurately reflects the content of the course as it will be taught. EE351 in the current program is revised and reorganized into EE265 and EP214 in the new program.

xxi) *Changes to Subject Designation, Course Designation, Course Number and Term*

From: EE 432.3 VLSI Circuit Design 2(3L)

To: ***CME 342.3 VLSI Circuit Design 1(3L-1.5P)*** FIRST OFFERED 2013-14

Rationale: The course EE 432 "VLSI Circuit Design" was originally developed in the Department of Electrical Engineering. Since the Computer Engineering program did not yet exist, the subject designation was EE. In light of recent developments the designation CME is more appropriate. The change of Course Number represents the year the course will be taught in the Department of Electrical and Computer Engineering. The change of Term represents the term the course will be taught in the Department of Electrical and Computer Engineering. The change of Lab/Tut hours represents the change in the Lab/Tut component of the class.

xxii) *Change to Subject Designation, Calendar Designation, Course Number and Term*

From: EE 431.3 Logic Design Using FPGAs 2(3L-1P)

To: ***CME 341.3 Logic Design Using FPGAs 1(3L-1.5P)***
FIRST OFFERED 2013-14

Rationale: The course EE 431 "Logic Design Using FPGAs" was originally developed in preparation to the change of the Department of Electrical Engineering to the Department of Electrical and Computer Engineering Since the Computer Engineering program did not yet exist, the subject designation was EE. In light of recent developments the designation CME is more appropriate. The change of Course Number represents the year the course will be taught in the Department of Electrical and Computer Engineering. The change of Term represents the term the course will be taught in the Department of Electrical and Computer Engineering. The change of Lab/Tut hours represents the change in the Lab/Tut component of the class.

xxiii) *Change to Subject and Calendar Designation*

From: EE 332.3 Real Time Computing 2(3L)
To: CME 332.3 Real Time Computing 2(3L-1.5P)
FIRST OFFERED 2013-14
Rationale: The course EE 332 "Real Time Computing" was originally developed in preparation to the change of the Department of Electrical Engineering to the Department of Electrical and Computer Engineering. Since the Computer Engineering program did not yet exist, the subject designation was EE. In light of recent developments the designation CME is more appropriate. The change of Lab/Tut hours represents the change in the Lab/Tut component of the class.

xxiv) *Change Subject Designation, Calendar Designation and Title*

From: EE 331.3 Microprocessor Hardware and Software 1(3L)
To: CME 331.3 Microprocessor Based Embedded Systems 1(3L-1.5P)
FIRST OFFERED 2013-14
Rationale: The course EE 331 "Microprocessor Hardware and Software" was originally developed in preparation to the change of the Department of Electrical Engineering to the Department of Electrical and Computer Engineering. Since the Computer Engineering program did not yet exist, the Subject designation was EE. In light of recent developments the designation CME is more appropriate.

xv) *Change Calendar Designation and Term*

From: CME 451.3 Transport Networks 1(3L-1P)
To: CME 451.3 Transport Networks 2(3L-1P) *FIRST OFFERED 2014-15*
Rationale: The change of Term represents the term the course will be taught in the Department of Electrical and Computer Engineering. The change of Lab/Tut hours represents the change in the Lab/Tut component of the class.

xxvi) *Change Calendar Designation and Prerequisite*

From: CME 433.3 Digital Systems Architecture 1(3L-1P)
Prerequisite(s): EE 232 and EE 431
To: CME 433.3 Digital Systems Architecture 1(3L-1.5P)
Prerequisite: EE 232 and CME 341
FIRST OFFERED 2014-15
Rationale: The change in Prerequisite(s) represents the change to the EE431 class. The change of Lab/Tut hours represents the change in the Lab/Tut component of the class.

xxvii) *Change Calendar Designation and Prerequisite*

From: CME 435.3 Verification of Digital Systems 1(3L-1P)
Prerequisite(s): EE 431
To: CME 435.3 Verification of Digital Systems 1(3L-1.5P)
Prerequisite(s): CME 341
FIRST OFFERED 2013-14
Rationale: The change of Lab/Tut hours represents the change in the Lab/Tut component of the class. The change in Prerequisite(s) represents the change to the EE 431 class.

xxviii) ***NEW*** *courses*

Effective 2012-13 academic year
EE 202.3 – Electrical and Magnetic Circuits
EE 204.3- Basic Electronics and Electrical Power
EE 241.3 – Introduction to Electric Power Systems
EE 265.3- Discrete-Time Signals and Systems

Effective 2013-14 academic year
EE 205.1 – Safety and Stewardship in Electrical and Computer Engineering
EE 365.3 – Algorithms and Circuits with Finite-Precision Arithmetics
EE 465.3 – Design of a DSP System

Rationale: These new and revised courses are part of the revisions to the electrical engineering and computer engineering programs.

xxix) *CME Program Core and Focus Areas*

The **NEW** Computer Engineering Program Core and Focus Areas:

CME Program Core – for students entering the program in 2012-13
CME 331.3, CME 341.3, CMPT 116.3, CMPT 117.3, CMPT 214.3, EE 202.3, EE 205.1, EE216.3 EE 221.3, EE 232.3, EP 214.3, EE 265.3, EE 271.3, GE 348.3, RCM 300.3

CME Focus Areas - for students entering the program in 2012-13
Digital Systems: CME 332.3, CME 342.3, CME 433.3, CME 435.3, CME 451.3
Digital System Processing and Applications: EE 362.3, EE 365.3, EE 456.3, EE 461.3, EE 465.3 *Computer Software*: CMPT 270.3, CMPT 280.3, (Two of CMPT 332.3 or CMPT 350.3 or CMPT 370.3), (One of CMPT 432.3 or CMPT 434.3)

Rationale: The changes represent the reorganization of the CME Program, the change in the classes in the CME Program Core and the addition of the CME Focus Areas.

EE Program Core and Focus Areas

The **NEW** Electrical Engineering Program Core and Focus Areas

EE Program Core – for student entering the program in 2012-13
CME 331.3, CMPT 116.3, EE 202.3, EE 205.1, EP 214.3 EE216.3, EE 221.3, EE 232.3, EE 241.3, EE 265.3, EE 271.3, EE 481.3, GE 348.3, RCM 300.3,

EE Focus Areas – for students entering the program in 2012-13
Digital System Processing and Applications: CME 341.3, EE 362.3, EE 365.3, EE 456.3, EE 461.3, EE 465.3
Sensors, Circuits & Devices: EE 301.3, EP 313.3, EE 372.3, EE 402.3, EE 471.3, EE 472.3
Power & Energy: EE 341.3, EE 342.3, EE 441.3, EE 442.3, EE 443.3, EE 444.3

Rationale: The changes represent the reorganization of the EE Program, the change in the classes in the EE Program Core and the addition of the EE Focus Areas.

xxx) *Prerequisite Change*

From: CME 495.6 Capstone Design Project
Prerequisite(s): EE 395 and 81 credit units from (EN Four Year Common Core and CME Program Core)

To: ***CME 495.6 Capstone Design Project (First Offered 2014-15)***
Prerequisite(s): CME Program Core and 6 credit units from the CME Program Focus Areas
Prerequisite(s) or Corequisite(s): 9 additional credit units from the CME Program Focus Areas

Rationale: The change in Prerequisite(s) and Corequisite(s) represents the removal of the EE 395 class from the CME Program and the change in the classes in the CME Program Core.

xxxi) *Prerequisite Change*

From: EE 495.6 Senior Design Project
Prerequisite(s): EE 395 and 81 credit units from (EN Four Year Common Core and CME Program Core)

To: ***EE 495.6 Senior Design Project (First Offered 2014-15)***
Prerequisite(s): EE Program Core and 6 credit units from the EE Program Focus Areas
Prerequisite(s) or Corequisite(s): 9 additional credit units from the EE Program Focus Areas

Rationale: The change in Prerequisite(s) and Corequisite(s) represents the removal of the EE 395 class from the EE Program and the change in the classes in the EE Program Core.

xxxii) *Prerequisite Change*

From: CME 433.3 Digital Systems Architecture
Prerequisite(s): EE 232 and EE 431

To: ***CME 433.3 Digital Systems Architecture***
Prerequisite(s): EE 232 and CME 341

Rationale: The change in Prerequisite(s) represents the change to the EE431 class.

From: CME 435.3 Verification of Digital Systems
Prerequisite(s): EE 431

To: ***CME 435.3 Verification of Digital Systems***
Prerequisite(s): CME 431

Rationale: The change in Prerequisite(s) represents the change to the EE 431 class.

xxxiii) *Prerequisite Change*

From: CME 451.3 Transport Networks
Prerequisite(s): CMPT 270 and CMPT 280 and (EE 232 or CMPT 320 or EP 321)

To: ***CME 451.3 Transport Networks***
Prerequisite(s): EE 232 or CMPT 320

Rationale: The change if the Focus Areas of the new Computer Engineering program represents the change in the Prerequisite(s) component of the class.

New courses for Electrical and Computer Engineering program s

EE 204.3 Basic Electronics and Electrical Power
3lecture; 1.5 lab Prerequisites: Math 123, 124; PHYS 155
This is a basic course on electrical topics for non-electrical engineering disciplines. It explores basic electrical and electronic devices as well as AC power and energy
Rationale: This course complements PHYS 155. EE204 is designed as a service course covering topics in electrical engineering required in the programs for mechanical and chemical engineering. This material was formerly given in EE201; however, changes to EE201 render that course less suitable for this purpose.

EE 205.1 – Safety and Stewardship in Electrical and Computer Engineering
0.5 Lecture
This course explores issues involving safety and environmental concerns in the context of the practice of electrical and computer engineering
Rationale: this course fulfills a requirement for accreditation of engineering programs by the Canadian Engineering Accreditation Board.

EE 241.3 – Introduction to Electric Power Systems
3 lecture, 1.5 lab Prerequisites: Math 123, 124; PHYS 155
This course introduced the fundamentals and building blocks of power systems. Topics include: power in the sinusoidal steady state; single-and three-phase transformers.
Rationale: This is a core course in the revised EE program, It introduced key concepts and devices related to electrical power systems.

EE 265.3- Discrete-Time Signals and Systems
3 lecture; 1.5 lab Prerequisites: Math 123, 124 Pre or co requisite: CMPT 116
Introduced the fundamental concepts and techniques for the modeling and analysis of discrete – time signals and linear systems.
Rationale: EE 265 is a core course in the revised EE program.

EE 365.3 – Algorithms and Circuits with Finite-Precision Arithmetics
3 lecture; 1.5 lab Prerequisite: EE362 Digital Signal Processing I
The intent of this course is to instill in students the cost-performance tradeoffs associated with implementing mathematical functions/concepts with digital circuits.
Rationale: One of the six courses that establish the Digital Signal Processing and Applications stream.

EE 465.3 – Design of a DSP System
3 lecture; 3 lab
Students will be guided through the design and implementation of a complex DSP-based system.
Rationale: One of the six courses that establish the Digital Signal Processing and Applications stream

College Statement

Attached to the proposal document should be a statement from the College which contains the following:

1. *Recommendation from the College regarding the program*
2. *Description of the College process used to arrive at that recommendation*
3. *Summary of issues that the College discussed and how they were resolved*

Attached

Related Documentation

Include any related documentation which is relevant to this proposal, such as:

- Excerpts from the College Plan and Planning Parameters
- SPR recommendations
- Relevant sections of the College plan
- Accreditation review recommendations
- Letters of support
- Memos of consultation

It is particularly important for Council committees to know if a curriculum changes are being made in response to College Plans and Planning Parameters, SPR recommendations or accreditation recommendations.

Consultation Forms

Attach the following forms, as required

Required for all submissions:	Consultation with the Registrar form
Required for all new courses:	Course proposal forms, or Calendar-draft list of new and revised courses
Required if resources needed:	Information Technology Requirements form Library Requirements form Physical Resource Requirements form
Required if budget allocation needed:	Budget Consultation form

M E M O R A N D U M

TO: Cathie Fornssler, Administration Officer
Academic Program Committee
E245, Administration Building

FROM: Nurul Chowdhury, Associate Dean, Student Affairs
Engineering Student Centre

DATE: January 13, 2012

RE: Electrical and Computer Engineering Revised Programs for University Council and College Statement

****

At the College of Engineering Academic Programs & Standards Committee meeting the following was approved with the complete revision of the EE/CME package:

> *To DELETE from the revised EE and CME programs STAT 241 from first term of second year and MATH 264 from second term of second year and to restore EE 216 to second term of second year.*

Rationale: We have revisited the need for the two extra mathematics courses in our revised programs. The two courses, covering linear algebra and statistics, were added to the programs to remedy a deficiency noted in the recent accreditation report for the Computer Engineering program. The letter from the Canadian Engineering Accreditation Board (CEAB) states under the heading Concern that "This program may have insufficient coverage of linear algebra, and probability and statistics." A Concern is the lowest category of deficiency and points to a possible problem with a program; it does not require an immediate remedy although failure to address the concern might lead to a higher category of deficiency. There is no guideline in the letter as to how much additional linear algebra, and probability and statistics would be considered sufficient. Frankly, our new curriculum committee was divided on whether the additional math courses are needed with some members preferring to alter existing courses to include more of the required topics.

In a meeting on January 5, 2012 between the department head and the principles of the new curriculum committee, we considered our options. Enthusiasm for including the Math courses was considerably muted, and in the end we agreed to forego adding the courses, instead opting for altering the existing course EE216 to increase the probability and statistics component as well as add some linear algebra. To make room for the extra material, the numerical methods component of the course will be reduced. If in the next accreditation review linear algebra, and probability and statistics are still an area of concern then we will revisit adding additional appropriate math courses to the programs.

College of Engineering Statement

Engineering Physics

The College of Engineering supports the revision of the Bachelor of Engineering program in Engineering Physics. The revisions allow for more collaboration between the Department of Physics and Engineering Physics and the Department of Electrical and Computer Engineering in their course offerings in second and third year. They also strengthen the Engineering Physics program academically in the areas of advanced mechanics, optics, and advanced electromagnetism. Furthermore, they allow for a much better and more attractive selection of elective courses for Engineering Physics students in 4^{th} year.

The program revisions were thoroughly discussed first by the Engineering Physics Curriculum Committee within the Department of Physics and Engineering Physics and the Department of Physics and Engineering Physics. After approval by the Department of Physics and Engineering Physics on October 4, the proposal was reviewed and discussed and finally approved by the Academic Programs and Standards Committee in Engineering in their meeting on October 19.

The pertinent course changes and new courses were also reviewed and discussed and finally approved by the BSc Programs Committee in the College of Arts and Science, which has resource and academic authority over the Department of Physics and Engineering Physics. The BSc Programs Committee in Arts and Science met on December 6.

Due to the good work of the Engineering Physics Curriculum Committee and the close collaboration with Electrical and Computer Engineering, no particular issues needed to be further resolved at College committee level.

The College recommends implementation of the revised Engineering Physics program and looks forward to successful collaboration between the Department of Physics and Engineering Physics and the Department of Electrical and Computer Engineering in the delivery of their new programs.

Electrical and Computer Engineering

The following is our response to the issues raised by the APC regarding the changes to the Electrical Engineering and Computer Engineering programs.

1. *Clarification with Mathematics and Statistics regarding whether the cost of additional markers would be covered by Engineering or by Arts and Science.*

Before the holiday break, we inquired of Math what the costs would be. The amount requested by Math is significantly beyond anything that could be covered from our budget. Although the amount may have been merely an initial proposal subject to negotiation, it was so out-of-line with our expectations that we were compelled to reexamine the need for the two new Math courses in second year.

The two courses, covering linear algebra and statistics, were added to the programs to remedy a deficiency noted in the recent accreditation report for the Computer Engineering program. The letter from the Canadian Engineering Accreditation Board (CEAB) states under the heading Concern that "This program may have insufficient coverage of linear algebra, and probability and statistics." A Concern is the lowest category of deficiency and points to a possible problem with a program; it does not require an immediate remedy although failure to address the concern might lead to a higher category of deficiency. There is no guideline in the letter as to how much additional linear algebra, and probability and statistics would be considered sufficient. Frankly, our new curriculum committee was divided on whether the additional math courses are needed with some members preferring to alter existing courses to include more of the required topics.

In a meeting last week between the department head and the heads of the EE and CME programs, we considered our options. Enthusiasm for including the Math courses was considerably muted, and in the end we agreed to forego adding the courses, instead opting for appropriately altering the existing course EE216. If in the next accreditation

review linear algebra, and probability and statistics are still an area of concern then we will revisit adding additional courses. This change to the revised programs has been approved by the college APSC.

2. *You should include some information regarding how you will deal with accreditation requirements for articulation of learning outcomes and program goals. For example, a summary of accreditation board expectations on this issue would be useful.*

I am not sure what the APC desires or what information is needed by council. The revisions do not change the general goals of the programs which is to provide accredited education in the fields of Electrical and Computer Engineering and to enable our graduates to be successful professional engineers in their respective fields.

I believe this comment refers to the changes that are occurring in engineering accreditation and the implementation of an outcomes based assessment which will need to be in place by our next accreditation review in 2014. However, we cannot provide a detailed outcomes analysis because the request is premature. There is still uncertainty within the college about what the CEAB requires and how we will proceed with the analysis, not just for our programs but for all the programs offered by the college. Currently, we are just starting the first step which is mapping courses to attributes; much work is left to do over the next two years. It would not be meaningful to provide a list of learning outcomes for our programs that goes beyond the general categories supplied by the CEAB.

Also, I feel the accreditation issues are not directly relevant to our program revisions. The primary goal of the revisions is not to align our programs with the new accreditation requirements. We are hopeful that the new administrative structure, with managers for each focus area, will make the work of preparing for the accreditation review easier. Further, the revised programs should be no more difficult to analyze than our current programs. But the motivation for the revisions has always been academics.

3. *You should include the information you provided to the committee on how you intend to deal with transition students.*

We are of course fully committed to all students who are enrolled in our current programs. As the revisions to the programs are implemented year-by-year, there are certain courses that will be altered or deleted. For those of our current students who spread their coursework over more than four years, who leave for a year of internship, or who fail and must retake a course, the possibility exists that required courses will be no longer offered. As these situations arise, we will accommodate the affected students. In most cases, there is an equivalent course that the students can substitute. In certain special cases involving EE351 and EE352, the accommodation might be more involved perhaps requiring the student to take two courses or to go off campus to take an additional course. These situations will be dealt with on a case-by-case basis. The laboratory courses might also be a potential problem; however, it is very rare for a student to be required to repeat a laboratory course.

We anticipate that only some students currently in their second year will be affected by the program changes. More advanced students have at least two years to pass courses slated for change or deletion. Once the revised programs have gained final approval, we will inform all of our current students of the changes and advise them of what they should do to minimize the impact on their programs of study.

Memorandum

To: Brian Daku, Department Head
Dept of Electrical and Computer Engineering
From: Michael Horsch, Undergraduate Chair,
Department of Computer Science
Phone 966-2161, Email: horsch@cs.usask.ca
Date: Monday 17 October 2011
RE: Proposed Changes to the Electrical and Computer Engineering Program

---

On behalf of the department of Computer Science, I am confirming that we are aware of the proposed changes to the Electrical and Computer Engineering Undergraduate programs. We are able to support the proposed program, insofar as our courses are concerned. We will continue to work with the ECE faculty by managing the Computer Software Stream of the CME program.

Memorandum

To: University Council

CC: N. Chowdhury, Associate Dean - Student Affairs, College of Engineering

From: A. Phoenix, Assistant Dean – Undergraduate Administration

Date: January 10, 2012

Re: Response to the issues about accreditation raised by the APC with respect to the changes in the Electrical Engineering, Computer Engineering and Engineering Physics programs

---

As the Assistant Dean responsible for accreditation matters within the College of Engineering, I felt that I should address some of the concerns raised by the APC about the accreditation of the proposed Electrical Engineering, Computer Engineering and Engineering Physics programs.

I have reviewed the programs for content and compared them against the Canadian Engineering Accreditation Board (CEAB) requirements. The three proposed programs all meet and exceed the standards with respect to the required inputs in Natural Science, Complementary Studies, Math, Engineering Science, and Engineering Design. Indeed the new structure makes accounting of these required CEAB inputs easier to manage and control. The analysis that I completed ensured that the proposed programs contained and strengthened the necessary elements of linear algebra, probability and statistics that were identified as a concern within the Computer Engineering program on its most recent accreditation visit. I am confident that from the input-side, the proposed programs are meeting the accreditation requirements.

The APC also asked for some information regarding how we would deal with the accreditation requirement for articulation of learning outcomes and program goals. To put this into context, the CEAB has dictated that starting in the fall of 2014, "there must be processes in place that demonstrate that program outcomes are being assessed in the context of the graduate attributes, and that the results are applied to the further development of the program."[1] This directive from the CEAB is moving us from the previous input-based-model to a combined input- and outcomes-based-model. That is, not only will we have to account for our inputs as we have in the past, we will have to find mechanisms to measure the outcomes of our efforts.

In addressing the APC's concerns, the program goals have not changed with the proposed program changes and articulation of our success in achieving the programs' goals will be done within the context of the 12 graduate attributes defined by the CEAB. This same challenge exists for all nine engineering programs.

To move towards a functioning outcomes-based-assessment model by the fall of 2014 FOR ALL OF OUR PROGRAMS, the College of engineering has taken the CEAB's 12 graduate attributes and broken them down into specific, and more measurable, indicators. We are in the process of mapping where, and to what extent, these indicators are present in each course of each program. In anticipation of the proposed programs being passed by Council, this mapping process is being completed for the proposed programs, not the old programs. Although the detailed mapping of the new programs is not complete at this time, the graduate attributes were considered when

---

[1] 2010 Canadian Engineering Accreditation Board – Accreditation Criteria and Procedures. Engineers Canada.

developing the proposed program structures and I do not anticipate any significant concerns or "holes" to arise from the process.

The mapping process will help us to identify key courses to perform outcome assessment within our programs. The College of Engineering is working closely with the Gwenna Moss Centre for Teaching Effectiveness to develop effective and consistent assessment tools to measure the graduate attributes and their indicators. It is anticipated that measurement of some indicators will begin within the January, 2012 academic term.

In summary, the three proposed programs are in a good position to address the CEAB accreditation requirements, both the input requirements and the forthcoming outcomes-based-assessment requirements. The full details of the outcomes-based-assessment strategy have not yet been fleshed out for any of the engineering programs, but with the proposed programs, their structure and program management strategies create an environment where measurement points can be quickly identified, assessments can be made, and program/content changes can be determined implemented as required to address any program performance concerns.

Regards,

Professor Aaron Phoenix, Ph.D., P.Eng.

Assistant Dean – Undergraduate Administration

College of Engineering