University of Windsor
Program Development Committee

*5.13: **Electrical and Computer Engineering - Summary of Minor Course and Calendar Changes**

Item for: **Information**

Forwarded by: **Faculty of Engineering**

INSTRUCTIONS ARE PROVIDED IN SHADED AREAS. DO NOT WRITE IN SHADED AREAS.

PART A

Please indicate with an "X" whether this change will be made to the undergraduate calendar or the graduate calendar, or both.	
_x__	The changes below, minor and largely editorial, will be made to the **Undergraduate Calendar**. These changes required no new resources.
__	The changes below, minor and largely editorial, will be made to the **Graduate Calendar**. These changes required no new resources.

When will these proposed change(s) be effective? [include semester and year]**:**	Fall 2014

PART B

Please list the course number and indicate with an "X" the changes that are being made. Add rows to the table as required. Full details on the proposed change(s) are to be provided in Part C.

Current course number	Deleting courses which are not part of any program's degree requirements*	Course calendar description changes	Pre/anti/co-requisite changes	Contact hour/ laboratory requirement changes	Course title changes	Renumbering courses	Cross-listing courses
88-225				X			
88-313				X			
88-316				X			
88-419				X			
88-432				X			
88-433				X			
88-434				X			
88-435				X			
88-436				X			
88-437				X			
88-438				X			

88-439				X			
88-440				X			
88-445				X			
88-447				X			
88-449				X			
88-450				X			
88-457				X			
88-460				X			
88-211				X			
88-217				X			
88-224				X			
88-226				X			
88-228				X			
88-324				X			
88-327				X			
88-329				X			
88-330				X			
88-431				X			
88-443				X			
88-444				X			
88-448				X			

**If the deleted course was a required course in any program, the proposed deletion must be presented on a PDC Form C.*

PART C

Please provide the current and the proposed new course information by cutting and pasting from the current undergraduate or graduate web calendar (www.uwindsor.ca/calendars) and clearly marking deletions with strikethrough (~~strikethrough~~) and additions/new information with bolding and underlining.

For contact hour/laboratory requirement changes which do not always appear in the calendar, please type in the current information and clearly mark deletions with strikethrough (~~strikethrough~~) and additions/new information with bolding and underlining.

Example: **03-101. University Senates ~~– Role and Power~~** ~~This course explores the history, role, and power of Senates in Canadian universities. (Also offered as 04-101.)~~ (Prerequisite: 03-100.) ~~2 lecture hours and 1 tutorial hour per week~~ **3 lecture hours/week**

88-225. Physical Electronics
Free electron theory of metals; Fermi level, work function; resistivity; band theory of solids, Fermi-Dirac distribution, density of states; semiconductors, donor and acceptor states; Hall effect; semiconductor devices, Field-Effect Transistors; dielectric materials and devices; semiconductor devices; P-N junction diodes, Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFET), and Bipolar Junction Transistors (BJT). (Prerequisites: 62-215 and 62-216) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

Students must have completed all the 1st year courses and at least ten (10) of their 2nd year courses

before being allowed to register into the 3rd year courses including all pre-requisite courses required for registration into the 3rd year courses.

88-313. Electromechanical Systems
Machinery principles; transformers; AC machinery fundamentals; synchronous generators; synchronous and induction motors; DC machinery fundamentals; DC motors; electromechanical energy conversion; three-phase concepts; special-purpose motors. (Prerequisites: 62-215, 62-216, 85-214 and 88-225.) (3 lecture. ~~1.5~~ **2** laboratory hours or equivalent a week.)Credit Weight ~~3.75~~. **4.**

88-316. Electronics II
Analog amplification; small-signal modeling of analog circuits; differential-amplifier topology; BJT, MOSFET and JFET differential amplifiers; frequency response and time-dependent circuit behavior; feedback and stability; multistage and power amplifiers; active filters and oscillators; use of CAD in modern transistor circuit design. (Prerequisites: 62-215, 62-216 and 88-226.) (3 lecture. ~~1.5~~ **1.5** laboratory hours **and 1 hour tutorial** ~~and or equivalent a week~~.)Credit Weight ~~3.75~~. **4.25.**

Students cannot register into any of the 4th year courses until all Electrical Engineering courses from 1st , 2nd and 3rd year have been completed.

88-419. Digital Communications
Digital communication systems; discrete Fourier transform; sampling theory; A/D converters; digital modulation; time-division multiplexing; packet transmission; random processes and spectral analysis for digital systems; error probabilities; noise; introduction to information theory. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75~~. **4.**

88-432. EM Waves and Radiating Systems
Maxwell equations; time varying potentials; time harmonic fields; electromagnetic wave propagation; wave polarization; power and Poynting vector; transmission lines; Smith chart; rectangular waveguides; waveguide current and mode excitation; dipole antenna; small loop antennas; antenna characteristics; antenna arrays. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** tutorial hours a week.) Credit Weight ~~3.75.~~ **4.**

88-433. Digital Integrated Circuit Design
Physics and modelling of MOSFETs; fabrication and layout of CMOS integrated circuits; the CMOS inverter: analysis and design; switching properties of MOSFETs; static logic gates; transmission gate logic circuits; dynamic logic circuit concepts; CMOS dynamic logic families; CMOS differential logic families; design methodologies and CAD tools; deep-submicron implementations. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.)Credit Weight ~~3.75.~~ **4.**

88-434. Automotive Electronics
Proportional-Integral-Derivative (PID) controllers and limit cycle controllers; fundamentals of digital control of Spark-Ignition (SI) engine; MPC555 Motorola Power PC**/dSPACE** based SI engine control system; Motronic engine management system; automotive sensors and actuators; vehicle motion control including Antilock Braking System (ABS); Controller Area Network (CAN); Time-Triggered CAN (TTCAN); FlexRay. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.)Credit Weight ~~3.75.~~ **4.**

88-435. Microelectromechanical Systems
MicroElectroMechanical System (MEMS) technology overview and design process; microfabrication and process integration; lumped element modeling; 3-D finite element modeling; energy conserving transducers (electrostatics); linear and nonlinear system dynamics; elasticity, stress, strain, material properties; structure analysis, beams, plates; MEMS sensing and actuation; material case studies; MEMS design methodology;

device modeling. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-436. Computer Communications
Protocols and architecture; data transmission; data encoding; interfacing; data link control; multiplexing, ISO reference model; wide-area networks; circuit switching; packet switching; ATM and frame relay; LAN technology and systems; internet protocols; inter-network operation; transport protocols; network security. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) 3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-437. Intelligent Computing
Computing models of the human mind. Neural computing models and learning algorithms. Fuzzy set theory and fuzzy systems. Evolutionary computing. Applications of intelligent computing. (Prerequisites:completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year in an Engineering program or fourth year standing in a Computer Science program.) 3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-438. Coding and Information Theory
Abstract algebra, number theory and complexity theory; simple cryptosystems; Shannon's theory; entropy and information theory; data encryption standard, RSA system and factoring; public-key cryptosystems; signature schemes; hash functions; key distribution and key agreement; identification schemes; authentication codes; access structures and general secret sharing; pseudo-random number generation; zero-knowledge proofs (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year) 3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-439. Multimedia Systems
Multimedia signals: Audio fundamentals; the Human visual system and perception; multimedia data acquisition. Multimedia signal compression: Transforms and subband decomposition; text representation; digital text, audio, image, and video compression. Multimedia signal processing: Digital audio, image, and video processing. Multimedia systems. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year) 3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-440. Wireless Communications
Introduction to wireless communications; cellular system design fundamentals; propagation path loss; fading and multi-path propagation; modulation techniques; diversity; coding and equalization; speech coding for wireless communications; multiple access networking, wireless communications protocols; satellite communication systems. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) 3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-445. Power Electronics
Power diodes; thyristors; power Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFET)Insulated-Gate Bipolar Transistors (IGBT); controlled rectifiers; DC-DC converters; inverters; AC-AC converters; gate drive circuits; motor drives; ~~r~~ computer simulation of power electronics and motor drives. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-447. Computer Networks Security
Introduction to computer networks security; cryptography; public-key and secret key encryption; encryption algorithms; network security mechanisms and techniques; security protocols; authentication and network security services; traditional and emerging Information Technology (IT) security; cyber-security. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-449. Sensor and Vision Systems
Basics of sensors and transducers; sensor characteristics and applications; fundamentals of pressure,

temperature, displacement and position sensors; accelerometer physics, strain gauges, and torque sensors; machine vision; image processing, image enhancement, edge and corner detectors; image segmentation techniques; image feature extraction and matching; color models and processing; object recognition and classification; discussion on camera parameters and calibration; stereo vision, 3D range imaging techniques. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours a week.) Credit Weight ~~3.75.~~ **4.**

88-450. Power Systems I
Principles of operation, modeling and analysis of electric power systems; complex power, phasors and per-unit system; three-phase circuits; power transformer and generator modeling; transmission line parameters; steady-state operation of transmission lines; network matrices and power flow analysis; introduction to alternative energy sources. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-457. Fundamentals of Digital Signal Processing
Discrete time signals and systems models and analysis; Z-transform; discrete Fourier transform (DFT); FFT algorithms; FIR filter design; IIR filter design; stability; realization; hardware and software implementations; digital signal processing applications. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) 3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-460. Power Systems II
Advanced analytical tools; analysis of abnormal operation, numerical methods, stability and control; transient stability and voltage stability; control and monitoring of power systems; dynamics and control of multi-machine systems; symmetrical faults; symmetrical components; unsymmetrical faults; power system protection and relaying; economic dispatch; optimal power flow; numerical simulation tools in power systems. (Prerequisites: 88-450 and completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

The following changes are subject to Departmental and Faculty Coordinating Council approvals:

88-211. Computer-Aided Analysis
Object oriented programming in C++ covering most of the basic concepts. Development of Classes for matrix operations, complex numbers, etc. The rest of the course covers class development for a set of numerical schemes that include: Gauss-Jordan Method for solving Linear Simultaneous Algebraic Equations; Matrix inversion; Root finding using the Newton-Raphson and the half-interval methods; Lin-Bairstow method for Roots of Polynomials; Least-squares fitting; Numerical Integration using the Trapezoidal and Simpson's 1/3 rule; Solution of Ordinary Differential Equations of any order using Euler, Improved Euler and the fourth-order Runge-Kutta methods. (Corequisite: 62-216) (3 lecture, 1.5 tutorial hours a week.) Credit Weight 3.75 (Prerequisite: 62-140.) (Credit cannot be obtained for both 85-211 and 88-211.)(Corequisites: 62-215 and 62-216) (3 lectures, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-217. Digital Logic Design I
Boolean algebra and logic gates; simplification of Boolean functions; arithmetic operations; analysis and design of combinatorial logic circuits with SSI, MSI, and LSI; sequential logic components; registers; counters and memory units; analysis and synthesis of sequential synchronous and asynchronous networks. (Co-requisites: 62-215 and 62-216) (3 lectures, ~~1.5~~ **2** Laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

88-224. Signals and Systems
Discrete and Continuous-Time Signals and Systems, Discrete and Continuous-Time Linear Time-Invariant Systems, System Analysis in Time Domain, System Analysis in Frequency Domain, Convolution, Differential Equation Models, Fourier series, the Fourier Transform, the Laplace Transform and it's Applications, Sampling of Systems. (Prerequisites: 62-215 and 62-216) (3 lecture. ~~1.5~~ **1.5** laboratory hours **and 1.5 tutorial hours** ~~and or equivalent~~ a week.) Credit Weight ~~3.75.~~ **4.5.**

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SUMMARY OF COURSE AND CALENDAR CHANGES
FORM "E"

88-226. Electronics I
Classification of signals; introduction to diodes; rectifier circuits, Zener diode, limiting and clamping circuits; Op amp amplifier configurations, Op amp distortion, non ideal op amp performance; active filters, Tow-Thomas Biquad; Introduction to data converters; oscillators; super-diodes; pulse generation. ~~(Corerequisite: 88-224)~~ (Prerequisites: 62-215 and 62-216) (3 lecture. ~~1.5~~ **1.5** laboratory hours **and 1.5 tutorial hours** ~~and or equivalent~~ a week.) Credit Weight ~~3.75.~~ **4.5.**

88-228. Electromagnetic Fields
Static electric fields; Coulomb's law, Gauss's law and its applications; electric potential; dielectrics; boundary conditions; capacitance; resistance; steady electric currents, current density, boundary condition for current density, equation of continuity and Kirchhoff's law; power dissipation; static magnetic fields; Biot-Savart's law, Ampere's law; vector magnetic potential; magnetic dipole; magnetic circuits; boundary conditions for magnetic fields; magnetic forces and torque; induction current. (Prerequisites: 62-215 and 62-216) (3 lecture, ~~1.5~~ **2** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.**

Students must have completed all the 1st year courses and at least ten (10) of their 2nd year courses before being allowed to register into the 3rd year courses including all pre-requisite courses required for registration into the 3rd year courses.

88-324. Control Systems I
Transfer function and state-space model for linear time-invariant systems; linearization of nonlinear systems; controllability and observability; transient performance; stability; tracking performance; Proportional-Integral-Derivative (PID) control design; frequency response and root locus (Prerequisites: 62-215,62-216.88-313.) (3 lecture. ~~1.5~~ **1.5** laboratory hours **and 1.5 tutorial hours** ~~and or equivalent~~ a week.) Credit Weight ~~3.75~~. **4.5.**

88-327. Microprocessors
Microprocessor systems (8 and 16 bit) and architecture; data representations, arithmetic units; memory structures; complex instruction set; accumulator, index, and memory reference instructions; addressing modes; stacks, subroutines, and other instructions; interrupts and timing; interfacing I/O devices and data converters; software development systems and assemblers; code implementation on microcontrollers. (Prerequisites: 62-215, 62-216, 88-217, 88-316 and 88-330.) (3 lecture, ~~1.5~~ **3** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.5.**

88-329. Analog Communications
Analog communication systems; information measure; signals and noise; Fourier transform and spectra; bandwidth of signals; analog modulation and demodulation systems; AM, FM, TV transmitters and receivers, detector circuits. (Prerequisites: 62-215, 62-216, 85-214 and 88-316.) (3 lecture. ~~1.5~~ **1.5** laboratory hours **and 1.5 tutorial hours** ~~and or equivalent~~ a week.) Credit Weight ~~3.75.~~ **4.5.**

88-330. Digital Logic Design II
Contemporary digital system design; programmable logic; device architectures; reconfigurable computing; design entry methods; VHDL (Hardware Description Language); Electronic Design Automation (EDA) tools; combinational and sequential logic design, implementation using programmable logic devices. (Prerequisites: 62-215, 62-216 and 88-217.) (3 lecture, ~~1.5~~ **3** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75~~. **4.5.**

Students cannot register into any of the 4th year courses until all Electrical Engineering courses from 1st , 2nd and 3rd year have been completed.

88-431. Control Systems II
Stability and performance analysis in frequency domain; lead-lag control design in frequency domain; elementary observer and control design in state space;
z- transformation and z-plane analysis; direct and indirect discrete-time control design; implementation of digital control. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture. ~~1.5~~ **1.5** laboratory hours **and 1.5 tutorial hours** ~~and or equivalent~~ a week.) Credit Weight ~~3.75.~~ **4.5.**

PROGRAM DEVELOPMENT COMMITTEE
SUMMARY OF COURSE AND CALENDAR CHANGES
FORM "E"

88-443. Embedded System Design
Embedded hardware and software systems; introduction to embedded systems; custom single-purpose processors, hardware design; general-purpose processors, software, design flow environment and tools, testing and debugging; standard single-purpose processors, peripherals, memory system design; interfacing issues, serial and parallel communication, bus standards, protocols and arbitration; exercises on real world applications; Laboratory implementation on modern Field Programmable Gate Arrays (FPGAs) and microcontrollers using associated Electronic Design Automation (EDA) tools. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **3** laboratory hours a week.) Credit Weight ~~3.75.~~ **4.5.**

88-444. Analog Integrated Circuit Design
Bipolar and Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFET) technology; device characterization; analog circuit modelling; current sinks, sources, and mirrors; differential pairs; current and voltage amplifiers; differential amplifiers; comparators; operational amplifiers; A/D and D/A converters; Integrated Circuit (IC) implementation with Electronic Design Automation (EDA) tools. (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **3** laboratory/tutorial hours or equivalent a week.) Credit Weight ~~3.75.~~ **4.5.**

88-448. Digital Computer Architecture
Computer Organization and architecture (32 bit); computer abstraction; reduced instruction set; high level to assembler level language translation; pipelinable instruction set architectures; speculation and branch prediction; instruction level parallelism; memory hierarchies, and virtual memory; secondary storage and I/O; multithreading, multicore, multiple CPU, and clustering; Graphics Processing Unit (GPU). (Prerequisites: completion of all Electrical Engineering courses from 1st year, 2nd year and 3rd year.) (3 lecture, ~~1.5~~ **3** laboratory/tutorial hours a week.) Credit Weight ~~3.75.~~ **4.5.**

Part D

Please indicate with an "X".	
Will the proposed changes result in changes to the learning outcomes of the course(s)?	
___	Yes. **If so, please complete the learning outcomes form and append new learning outcomes, as appropriate, to this Form E submission. (See attached for learning outcomes form))**
_x__	No.