AOLS REQUIREMENTS		CBEPS SYLLABUS ITEM	YORK GEOMATICS COURSE EQUIVALENT(S)			RYERSON GEOMATICS COURSE EQUIVALENT(S)		
Subject	**Description**	http://cbeps-cceag.ca/	**#**	**Course Name**	**Description**	**#**	**Course Name**	**Description**
MATHEMATICS	Functions, continuity and limits; Differentiation and applications; Integration, quadrature's and applications; Plan curves, tangency, and curvature; Sequences, series and Taylors expansions; Partial differentiation and differential operators; Multiple integrals and numerical approximations; Vector operations and analytical geometry' First and second order linear differential equations and solutions; Introduction of matrix algebra, linear equations and transformations; Complex variables, linear spaces and subspaces; Quadratic forms, orthogonal and unitary matrices; Spherical geometry and trigonometry.	**C1: Mathematics**	**SC/MATH 1013**	**APPLIED CALCULUS I**	Introduction to the theory and applications of both differential and integral calculus. Limits. Derivatives of algebraic and trigonometric functions. Riemann sums, definite integrals and the Fundamental Theorem of Calculus. Logarithms and exponentials, Extreme value problems, Related rates, Areas and Volumes. Prerequisite: SC/MATH 1515 3.00 or SC/MATH 1520 3.00, or a high school calculus course.	**MTH 140**	**CALCULUS I**	Limits, continuity, differentiability, rules of differentiation. Absolute and relative extrema, inflection points. Asymptotes, curve sketching, Applied max/min problems, related rates. Definite and indefinite integral, Fundamental Theorem of Integral Calculus, Areas, volumes, Transcendental functions (trigonometric, logarithmic, hyperbolic and their inverses).
			SC/MATH 1014	**APPLIED CALCULUS II**	Calculus in Polar Coordinates. Techniques of Integration. Indeterminate Forms. Improper Integrals. Sequences, infinite series and power series. Approximations. Introduction to ordinary differential equations.	**MTH 240**	**CALCULUS II**	Integration Techniques, L'Hopital's Rule, Improper Integrals.. Partial derivatives. Infinite sequences and series, power series. First-order differential equations, with applications,.
			SC/MATH 1025	**APPLIED LINEAR ALGEBRA**	Topics include spherical and cylindrical coordinates in Euclidean 3-space, general matrix algebra, determinants, vector space concepts for Euclidean n-space (e.g. linear dependence and independence, basis, dimension, linear transformations etc.), an introduction to eigenvalues and eigenvectors. Prerequisites: One 12U or OAC mathematics course or equivalent.	**MTH 141**	**LINEAR ALGEBRA**	Linear Algebra. Systems of linear equations and matrices. Determinants. Vector spaces. Inner product spaces. Eigenvalues and eigenvectors. Applications.
PHYSICS	Motion; Waves; Sound; Electric Charges and Fields, Magnetic Field and Forces, Electromagnetic Induction; Electromagnetic Waves, Propagation of Light, Optics and Optical Instruments, Interference and Diffraction.	**N. A.**	**SC/PHYS 2020**	**ELECTRICITY AND MAGNETISM**	The elements of electric and magnetic fields are developed, together with dc and ac circuit theory and an introduction to electromagnetic waves. Coulomb's law. Electric field.Gauss' law. Electric potential.Electrostatic energy. Capacitors and dielectrics.Current, resistance, ohm's law, dc circuits, q factor.Magnetic fields. Biot-savart law.Ampere's law. Magnetostatic energy. Faraday's law. Magnetic materials. Inductance. AC circuits, rms relations, impedance. Displacement current.Maxwell's equations.	**PCS 125**	**PHYSICS: WAVES & FIELDS**	Simple harmonic motion; motion of mechanical waves, wave speed, interference, standing waves and resonance; ray and wave models of light and its reflection, refraction and interference; gravitational fields and potential energy; electric fields and potential energy; electric potential; magnetic fields.
COMPUTING	One computer course that focuses on computer programming, website development, custom programming scripting, or application development. A Ryerson or York computer course that is completed through an engineering degree is acceptable. Alternative, on-line or night school courses will also be accepted (with course content approval by AERC). Examples of online courses include Introduction to ASP.NET, Introduction to C++, Introduction to Programming, Introduction to JavaScript, Introduction to Visual Basic, Mac, iPhone, and iPad Programming (All U of Waterloo online courses)	**N. A.**	If this course requirement is being fulfilled at York University, one the following courses would be considered a sufficient equivelent - LE/EECS 1011, LE/EECS 1541, CSE 1020, CSE 1030, CSE 2011, ESEE 2220, CSE 2501, MATH 1019, or MATH 1090.			If this course requirement is being fulfilled at Ryerson Univeristy, CPS 125 (Digital Computation and Programming) would be a sufficient equivelent.		
FUNDAMENTALS OF SURVEYING	Acquisition of Data by Field Survey Methods, and Processing these Data to Determine Positions and Direction; Field Note Procedures; Preparation of Maps of Physical and Cultural Phenomena; Coordinate Geometry; Curve Geometry; Earth Work Calculations; Digital Models; Error.	**C3: ADVANCED SURVEYING**	**LE/ESSE 2620**	**FUNDAMENTALS OF SURVEYING**	Coordinate systems, conventions and transformations. First and second geodetic problem: trig sections, traverses, eccentricities, areas. Distance measurements, angular measurements, heights. Topographic mapping and property surveys. Route surveying. Introduction to other surveys: alignment, deformation surveys for buildings, bridges, dams, tunnels, pipelines. Three lecture hours per week and three laboratory hours per week. One term. Four credits. Prerequisites: SC/EATS 1010 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/EATS 2610 2.00 or SC/ENG 2110 2.00; or permission of the course instructor.	**CVL 323**	**FUNDAMENTALS OF SURVEYING**	Overview of geomatics engineering program; Basic measurement methods, instrumentation and data analysis for determining elevations, angels, distances and point locations; Overview of satellite positioning and navigation, spatial and land information management, spatial imaging (Photogrammetry/remote sensing) and digital mapping; Relationships to related disciplines; and Role of geomatics professionals.
			LE/ESSE 3640	**GEODETIC SURVEYS**	Instrument systems and procedures for high-precision geodetic surveys. High-precision surveys in engineering physics; geodetic network densification adjustment and analysis; procedures for deformation surveys and strain analysis. Establishment and observation of control networks for construction and monitoring of large engineering structures.	**CVL 352**	**GEOMATICS MEASUREMENT TECHNIQUES**	Measurement techniques applied to geomatics engineering. Topics include: use of total stations and levels for angle distance, and elevation changes measurements, differential leveling and trigonometric heighting, traversing, control and topographic surveying, boundary surveys, route surveying, construction surveying, and land survey.
LEAST SQUARES ESTIMATION AND DATA ANALYSIS	Pre-Analysis and Design of Surveys; Error Analysis of Resultant Data and Techniques; High Precision Surveys, including Deformation Surveys; Application of Matrix Methods and the Computer to the Analysis of Survey Problems; Linear Equations and Their Methods of Solution; Linearization of Computational Models; Coordinate Transformations. Survey Control Systems; Statistical Analysis of Survey Data including Estimation of Variance Components; Regression Analysis; Models; Filters; Adjustment of Large Survey Networks; Estimation of Reliability and Accuracy of Survey Systems.	**C2: LEAST SQUARES ESTIMATION AND DATA ANALYSIS**	**LE/ESSE 2640**	**ADJUSTMENT CALCULUS**	Minima and maxima of functions, Weierstrass theorem, Lagrange multipliers. Quadratic forms. Observables, observations, parameters and mathematical models. The least squares principle; weight matrix and variance factor; parametric, condition and combined adjustments. Three lecture hours and one and a half hours of laboratory exercises per week. One term. Three credits. Prerequisites: SC/MATH 1025 3.00; SC/MATH 2015 3.00; LE/ESSE 2620 4.00 or LE/ENG 2120 4.00; LE/EECS 2501 1.00. Corequisite: LE/ESSE 3610 4.00 or LE/ENG 3110 4.00. Prior to Fall 2014: Prerequisites: SC/MATH 1025 3.00; SC/MATH 2015 3.00; LE/EATS 2620 4.00 or LE/ENG 2120 4.00; LE/CSE 2501 1.00. Corequisite: LE/EATS 3610 4.00 or LE/ENG 3110 4.00. Prior to Summer 2013: Prerequisites: SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/EATS 2620 4.00 or SC/ENG 2120 4.00; SC/CSE 2501 1.00. Corequisite: SC/EATS 3610 4.00 or SC/ENG 3110 4.00. Prior to Fall 2009: Prerequisites: AK/AS/SC/MATH 1025 3.00; AK/AS/SC/MATH 2015 3.00; SC/EATS 2620 4.00 or SC/ENG 2120 4.00; AK/AS/SC/CSE 2501 1.00 (formerly COSC). Corequisite: SC/EATS 3610 4.00 or SC/ENG 3110 4.00.	**CVL 737**	**DATA MODELLING & ESTIMATION**	Basic concepts of modeling and estimation, analysis of Geomatics measurements, measures of central tendency, introductory probability theory, Univariate statistical testing, covariance and correlation, principles of least squares methods, parametric, condition and combined cases.
			SC/MATH 2930	**INTRODUCTION TO PROBABILITY AND STATISTICS**	The aim of this course is to give students in various disciplines some fundamental tools in statistical inference. Through a mixture of theory given in lecture hours and practice acquired during lab time, the student will understand when and how to use statistical tools such as the z, t or chi-squared tests, regression analysis, analysis of variance and various other techniques. Prerequisites: High school MATH 11U or MATH 11U/C.	**MATH 405 or MTH 410**	**STATISTICS**	Statistics: Description of numerical data. Elements of probability theory. Discrete probability distributions (hypergeometric, binomial, geometric and Poisson distribution). Continuous probability distributions; uniform on an interval, Normal distribution, t-distribution, Exponential distribution, x^2 distribution. Confidence interval and hypothesis testing concerning mean, variance and proportion for one and two populations. F-distribution. Correlation. Simple linear regression (if time permits).
			LE/ESSE 3630	**ANALYSIS OF OVERDETERMINED SYSTEMS**	Hilbert space and statistics. Statistical testing and assessment of observations, parameters and mathematical models. Optimal design. Generalized adjustment, problems with constraints and singularities, step-by-step procedures, Kalman filtering, least-squares collocation. Prerequisites: AP/GEOG 2420 3.00 or SC/GEOG 2420 3.00, LE/ESSE 3610 3.00, LE/ESSE 3620 3.00. PRIOR TO FALL 2014: Prerequisites: AP/GEOG 2420 3.00 or SC/GEOG 2420 3.00, LE/EATS 3610 4.00 or LE/ENG 3110 4.00, LE/EATS 3620 4.00 or LE/ENG 3120 4.00. PRIOR TO SUMMER 2013: Prerequisites: AP/GEOG 2420 3.00 or SC/GEOG 2420 3.00, SC/EATS 3610 4.00 or SC/ENG 3110 4.00, SC/EATS 3620 4.00 or SC/ENG 3120 4.00.			
PHOTOGRAMMETRY and REMOTE SENSING	Analytical Principles and Procedures; Spatial Triangulation; Digital Photogrammetry; Soft Copy; Project Planning and Execution; Remotely Sensed Digital Images; Computer-Assisted Interpretation; Preprocessing and Pattern Recognition; Resource Mapping and Monitoring.	**C7: REMOTE SENSING AND PHOTOGRAMMETRY** **E4: ADVANCED REMOTE SENSING** **E5:ADVANCED PHOTOGRAMMETRY**	**LE/ESSE 4220**	**REMOTE SENSING OF THE EARTH'S SURFACE**	Principles used in extracting physical information about the Earth's surface using remote sensing. Remote sensing in the visible, short-wave infrared, thermal infrared and microwave regions is discussed in terms of potential applicability to forestry, agriculture, water resources and geology. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisite(s): SC/PHYS 2020 3.00, or SC/PHYS 2060 3.00, or both SC/PHYS 2211 1.00 and SC/PHYS 2212 1.00.	**CVL 354**	**REMOTE SENSINGAND IMAGE ANALYSIS**	Provides an overview of the fundamental principles of remote sensing and image analysis from a geomatics perspective. Topics include: nature of electromagnetic radiation, energy interactions, visual image interpretation, airborne and satellite platforms, optical and microwave sensors, image rectification and geocoding, image enhancement, multispectral transformation and classification, data fusion and GIS integration, applications to environmental monitoring and mapping, and term project.
			LE/ESSE 3650	**PHOTOGRAMMETRY**	Image and object space. Direct and inverse problems of projective and similarity coordinate transformations. Collinearity and coplanarity. Orientation procedures. Measurement and correction of image coordinates. Stereomodel formation and error analysis. Analog, analytical, independent model, strip and block adjustments. Image rectification. DEM generation. Digital Mapping Applications. Project planning. Three lecture hours and one and a half hours of laboratory exercises per week. One term. Three credits.			
GIS/LAND MANAGEMENT AND LAND INFORMATION SYSTEMS	Spatial Data Management Systems; Alternative Methods of Geo-Referencing; Spatial Data Representation; Creation and Revision of Digital Map Data; Data Integration and Geoprocessing; Hardware and Software Components of a GIS; Project Selection; Design and Implementation-, Review of Selected Geographic Information Systems in Canada.	**C5: GEOSPATIAL INFORMATION SYSTEMS** **E1: SPATIAL DATABASES AND LAND INFORMATION SYSTEMS**	**LE/ESSE 3600**	**GIS AND SPATIAL ANALYSIS**	The fundamental concepts and techniques of GIS are presented along with detailed discussion of computer implementation. The emphases include database management and map analysis/spatial modelling. PC ArcView with Spatial Analyst extension GIS programs are used for hands-on exercises. Normally offered in alternate years. Two lecture hours, three laboratory hours. One term.	**CVL 736**	**GEOSPATIAL INFORMATION SYSTEMS**	Introduction to geospatial information systems (GIS), overview of GIS data models, 2D geospatial data transformations, hardware/software components, functions and architecture; Comparative overview of alternative spatial data collection technologies; Data structures and database management systems for raster and vector data; Vector and raster data exploration and analysis; Introduction to spatial modeling and analysis; Process and Issues in GIS Implementation.

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Subject	**Description**	http://cbeps-cceag.ca/	**#**	**Course Name**	**Description**	**#**	**Course Name**	**Description**
GEODESY	Concepts and Evolution of Geodesy; Terrestrial and Satellite-Based Methods of Positioning; Introduction to Global Positioning Systems. Gravitational Potential; Gravity Field; Principles of Satellite and Inertial Positioning Systems; Levelling and Geopotential Numbers; Tidal Effects; Theory of Orbits; the Geoid.	**C4: COORDINATE SYSTEMS AND MAP PROJECTIONS** **C6: GEODETIC POSITIONING**	**LE/ESSE 3670**	**GLOBAL NAVIGATION SATELLITE SYSTEMS**	Satellite-based positioning, navigation and timing. Spatial and temporal reference systems. Orbital mechanics. GNSS signal structure, hardware, observables, and error sources. GNSS point positioning, relative positioning, and augmentation techniques. GNSS / inertial integration. GNSS evolution and applications. Course credit exclusions: LE/ESSE 4610 3.00. Prerequisites: LE/ESSE 3610 3.00; LE/ESSE 3620 3.00.	**CVL 650**	**SATELLITE GEODESY**	Basic concepts of satellite positioning, GPS signal structure, GPS modernization, GPS orbital determination, pseudorange and carrier-phase measurements, linear combinations of GPS observables, GPS errors and biases, development of mathematical models for absolute and relative positioning static, kinematic and real-time kinematic (RTK) GPS positioning, practical considerations, GPS augmentations.
			LE/ESSE 4620	**PHYSICAL AND SPACE GEODESY**	Local treatment of the Earth's gravity field. Boundary value problems. Normal and disturbing potential, the normal gravity formula. Geoid, geoidal undulations, deflections of the vertical. Stokes and Vening Meinesz formulae. Gravimetry and gravity reductions. Height systems. Tides. Gravity space missions. Three lecture hours weekly and three hours of laboratory exercises every other week. One term. Three credits. Prerequisites: SC/EATS 3020 3.00; SC/EATS 3610 4.00 or SC/ENG 3110 4.00; SC/EATS 3620 4.00 or SC/ENG 3120 4.00; SC/EATS 4610 3.00 or SC/ENG 4110 3.00.			
PROFESSIONAL AFFAIRS & BUSINESS LAW	Role and Responsibilities of Professions from the Historical, Ethical, Legal, Organizational and Commercial Perspectives; Exploration of the Fundamentals of Professional Judgement; Conduct; Practice Creation and Management. Attendance of the OSPE Prepatory Course for the Professional Practice Exam would also suffice as an equivelent. Overview of the Role and purpose of the Canadian Legal System; The Canadian Constitution; The Structure and Operations of our Civil Courts; The Establishment of Law, including Statutes and Common Law; The Impact of Laws on Individuals and Business Entities.	**C11: BUSINESS PRACTICES AND THE PROFESSION**	**LE/ENG 3000**	**PROFESSIONAL ENGINEERING PRACTICE**	An introduction to the legal ethical frameworks of the engineering profession, preparing students for the Professional Practice Examination required for certification as a professional engineer. Also covered are associated professional issues such as entrepreneurship, intellectual property and patents.	**CEN 800**	**LAW AND ETHICS IN ENGINEERING PRACTICE**	Study and analysis of the engineering profession, business corporations and organization, Tort liability and contract law, legal and ethical aspects of engineering practice, business contract law and conflict resolution, intellectual and industrial property, employment and labour law including occupational health and safety, WHMIS, corporate social responsibility, environmental considerations and sustainable development, international standards and trade.
LAND PLANNING	Fundamentals of obtaining Site Information to provide the Framework for Land Development; Subdivision Design; Economics of Development; Aggregate Resource Development; Condominium Legislation and Approval; Drainage Legislation and Engineering; Role and Involvement of the Professional Surveyor as a Member of the Multi-Disciplinary Planning Development Team; Effective Public Participation and Stakeholder Involvement; Strategies for Presentation.	**C8: LAND USE PLANNING AND ECONOMICS OF LAND DEVELOPMENT**			Not available at York University.	**Contact AOLS**	**MUNICIPAL PLANNING AND SURVEYING**	The function and structure of the Planning Act and other statutes that affect land use changes. Planning instruments and their interpretation; official and secondary plans, zoning bylaws, site plan controls, minor variances, land division by consent and by plan of subdivision. The subdivision design process. Integration of storm water management plans, wetlands and fisheries policies and other environmental controls, Municipal infrastructure design, location, operation and maintenance.
EFFECTIVE COMMUNICATION	Principles, Styles and Techniques of Technical Writing; Narrative; Descriptive; Expository and Persuasive Prose; Correct Grammar; Sentence and Paragraph Structure; Clarity, Precision and Consistency; Writing Memoranda, Business Letters, Announcements, Abstracts, Reports, Instructional Manuals, Brochures and Specifications; Basic Communication within an Organizational Structure; Presentation of Technical Information for a Variety of Audiences.	**N. A.**	**LE/ENG 2003**	**EFFECTIVE ENGINEERING COMMUNICATION**	This course comprises the technical writing instruction component of ENG 1000 6.00 Introduction to Engineering Design. Contents include writing ethics, proposals, team-written reports, and presentations. Corequisite: SC/ENG 1000 6.00.	**CMN432**	**COMMUNICATION IN THE ENGINEERING PROFESSIONS**	Communication lies at the heart of what engineers do. This course introduces students to the unique and varied communication challenges of their profession. Through a combination of lectures, readings, and workshops, students are exposed to the types of communication they will engage in as professionals and given the opportunity to refine their analytical, writing, presentation, and problem-solving skills.
				TECHNICAL REPORT	The candidate must demonstrate that they have the ability to produce a professional technical report, similar to an advanced Survey Report that is required for every project that a professional surveyor completes. The format is intended to resemble survey projects in practice, including scope of work, specifications, background research, summary of field investigations, innovative solutions, analysis, and communication. For candidates that cannot demonstrate this expertise through existing reports, ENG 4000 (Engineering Project) is considered an equivelent course at York University.		**TECHNICAL REPORT**	The candidate must demonstrate that they have the ability to produce a professional technical report, similar to an advanced Survey Report that is required for every project that a professional surveyor completes. The format is intended to resemble survey projects in practice, including scope of work, specifications, background research, summary of field investigations, innovative solutions, analysis, and communication. For candidates that cannot demonstrate this expertise through existing reports, CVL 855 (Capstone Project II) is considered an equivelent course at Ryerson University.
SURVEY LAW I: REAL PROPERTY	Real Property; Land Parcels and Property Rights; Survey Systems; Crown Lands; Grants and Surveys	**C9: CADASTRAL STUDIES**	**LE/ESSE 4660**	**CADASTRAL STUDIES**	Cadastral systems, survey law and the role of the professional land surveyor. The Dominion Lands Survey System and Land Surveys Acts and Regulations. Cadastral surveys, including surveys of Canada lands for aboriginal land claims and coastal boundaries. Land registration systems in Canada.			Not available at Ryerson University
SURVEY LAW II: PARCELS RECORDS AND BOUNDARIES	Creation of Boundaries; Principles of Evidence; Estoppel; Adverse Possession; Natural Boundaries; Description of Lands.	**C10: SURVEY LAW**	**LE/ESSE 4670**	**SURVEY LAW**	Property boundaries, survey monuments, party walls, fences, future issues. Natural boundaries formed by waters and the right of access. Property title issues, legislation, and standards of practice.			Not available at Ryerson University
HYDROGRAPHY	The learning outcomes of hydrography are divided into several sections including acoustics, bottom determination, water levels, water flow, horizontal positioning, vertical positioning and hydrographic survey practices and standards.	**C12: HYDROGRAPHY**	**LE/ESSE 4650**	**HYDROGRAPHY**	Hydrography and its role in offshore management. Elements of oceanography, tides and water levels, seabed and sea water properties. Underwater acoustics. Bathymetric and imaging methods. Marine positioning and navigation.	**GEOM 8195**	**HYDROGRAPHIC SURVEYING**	Provides an understanding of hydrographic surveying in sufficient depth to enable the student to plan, carry out, and evaluate proposals for such a survey. **BCIT - Distance Learning**