# Course Outline

## CENTENNIAL COLLEGE

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|---|---|
| School: | Eng. Tech. & Applied Science |
| Department: | Sustainable Design & Renewable Energy (SDRE) |
| Course Title: | Linear Algebra & Statistics |
| Course Code: | MATH 210 |
| Course Hours/Credits: | 56 |
| Prerequisites: | MATH 175, MATH 185 |
| Co-requisites: | N/A |
| Eligible for Prior Learning, Assessment and Recognition: | Yes |
| Originated by: | Najam Khaja |
| Creation Date: | Summer 2008 |
| Revised by: | Daniela Stanescu, Najam Khaja, Darshana Patel |
| Revision Date: | Summer 2020 |
| Current Semester: | Fall 2021 |
| Approved by: | |

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Chairperson/Dean

# Acknowledgement of Traditional Lands

Centennial is proud to be a part of a rich history of education in this province and in this city. We acknowledge that we are on the treaty lands and territory of the Mississaugas of the Credit First Nation and pay tribute to their legacy and the legacy of all First Peoples of Canada, as we strengthen ties with the communities we serve and build the future through learning and through our graduates. Today the traditional meeting place of Toronto is still home to many Indigenous People from across Turtle Island and we are grateful to have the opportunity to work in the communities that have grown in the treaty lands of the Mississaugas. We acknowledge that we are all treaty people and accept our responsibility to honor all our relations.

# Course Description

This course contains topics in Linear Algebra and Statistics. Linear algebra topics include operations with matrices, inverses, determinants, and vectors. Statistics topics include descriptive statistics, probability distributions as well as inferential statistics including hypothesis testing. Students will also use software applications in solving relevant problems.

# Program Outcomes

N/A

# Course Learning Outcomes

The student will reliably demonstrate the ability to:
1.  Perform operations with and on matrices.
2.  Calculate determinants.
3.  Solve systems of linear equations by use of matrices (Gauss elimination) and by use of determinants (Cramer's rule).
4.  Calculate the norm, dot product, and cross product of vectors.
5.  Construct and interpret various graphs to represent data.
6.  Calculate various measures of central location, position and variation for a set of data.
7.  Determine the least squares regression line and the linear correlation coefficient for bivariate data.
8.  Solve problems involving discrete and continuous probability distributions.
9.  Estimate population parameters from sample statistics.
10. Perform elementary hypotheses tests about a population parameter.

# Essential Employability Skills (EES)

The student will reliably demonstrate the ability to*:
3.  Execute mathematical operations accurately.
4.  Apply a systematic approach to solve problems.
5.  Use a variety of thinking skills to anticipate and solve problems.

*There are 11 Essential Employability Skills outcomes as per the Ministry Program Standard. Of these 11 outcomes, the following will be assessed in this course.*

# Global Citizenship and Equity (GC&E) Outcomes

N/A

# Text and other Instructional/Learning Materials

**Text Book(s):**

1) Linear Algebra Textbook - Linear Algebra for Math 210 Package (posted on e-Centennial)

2) Supplemental Package for Linear Algebra (posted on e-Centennial)

3) Statistics Textbook - Statistics for Math 210 Package (posted on e-Centennial)

4) Supplemental Package for Statistics (posted on e-Centennial)

**Material(s) required for completing this course:**

Scientific calculator

**Custom Courseware:**

Scilab (can be downloaded from www.scilab.org)

# Evaluation Scheme

⇨ Test 1: Topics: Systems of Linear Equations (solving systems by Gauss elimination),Basic operations involving matrices, Algebraic properties of matrices, Inverse of matrices, Diagonal, triangular and symmetric matrices, Finding determinants by cofactor expansion, Solving systems of equations by using Cramer's rule, Norm of a vector, Dot product, Cross product, Vector Projections, Scalar triple product of vectors.

⇨ Test 2: Topics: Graphic Representations for sets of data including the Stem and leaf plots, Measures of Central Tendency, Position, & Dispersion,The Least Squares Regression Line, The linear Correlation Coefficient, Discrete probability distributions (Mean, variance & standard deviation),Binomial probability distribution (Mean, variance & standard deviation), Continuous probability distributions, Normal distribution and the Standard Normal, Central Limit Theorem, Estimating population parameters from sample statistics, Hypotheses testing about a population parameter

⇨ Quizzes: Selected topics for quizzes will be announced in class.

⇨ Assignments: Selected topics for assignments will be announced in class.

⇨ Course requirement: In order to pass the course, students must achieve at least 50% in both Linear Algebra and Statistics portions of the course.

| Evaluation Name | CLO(s) | EES Outcome(s) | GCE Outcome(s) | Weight/100 |
|---|---|---|---|---|
| Test 1 | 1, 2, 3, 4 | 3, 4, 5 | | 25 |
| Test 2 | 5, 6, 7, 8, 9, 10 | 3, 4, 5 | | 25 |
| Quizzes | 1, 2, 3, 5, 6, 7, 8 | 3, 4 | | 30 |
| Assignments | 1, 2, 3, 5, 6, 7, 8 | 3, 4, 5 | | 20 |
| Course requirement | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 | 3, 4, 5 | | Pass/Fail |
| Total | | | | 100% |

If students are unable to write a test they should immediately contact their professor or program Chair for advice. In exceptional and well documented circumstances (e.g. unforeseen family problems, serious illness, or death of a close family member), students may be able to write a make-up test.

All submitted work may be reviewed for authenticity and originality utilizing Turnitin®. Students who do not

wish to have their work submitted to Turnitin® must, by the end of the second week of class, communicate this in writing to the instructor and make mutually agreeable alternate arrangements.

When writing tests, students must be able to produce official Centennial College photo identification or they may be refused the right to take the test or test results will be void.

Tests or assignments conducted remotely may require the use of online proctoring technology where the student's identification is verified and their activity is monitored and/or recorded, both audibly and visually through remote access to the student's computer and web camera. Students must communicate in writing to the instructor as soon as possible and prior to the test or assignment due date if they require an alternate assessment format to explore mutually agreeable alternatives.

## Student Accommodation

The Centre for Accessible Learning and Counselling Services (CALCS) (http://centennialcollege.ca/calcs) provides programs and services which empower students in meeting their wellness goals, accommodation and disability-related needs. Our team of professional psychotherapists, social workers, educators, and staff offer brief, solution-focused psychotherapy, accommodation planning, health and wellness education, group counselling, pscyho-educational workshops, adaptive technology, and peer support. Walk in for your first intake session at one of our service locations (Ashtonbee Room L1-04, Morningside Room 190, Progress Room C1-03, The Story Arts Centre Room 285, Downsview Room 105) or contact us at calcs@centennialcollege.ca, 416-289-5000 ext. 3850 to learn more about accessing CALCS services.

## Use of Dictionaries

- Dictionary use is not permitted in test or examination settings.

## Program or School Policies

**Testing:** a) No additional time will be allowed for any student who comes late to any test.b) No student will be allowed to leave during the first half-hour of any test.c) Unless otherwise stated, no written or other aids may be used during tests. Any student who is found using or having used unauthorized aids will be given a mark of zero for that test. Furthermore, a final grade of "F" may be given in this course. Every incident of cheating will be reported to the Campus Inquiry Officer and may entail serious consequences.d) There will be no rewrites of term tests (or exams where applicable).e) If a particular test cannot be written because of documented medical or compassionate reasons, a makeup test will be scheduled within 5 business days of the date of the evaluation. A mark of zero will be recorded in all cases where no reason (supported by official documentation) acceptable to the professor is provided within 5 business days of the date of the evaluation.f) All classroom instruction (that require calculators) will be based on the Sharp EL-520. During tests and examinations, students may use an equivalent scientific calculator; however, programmable and/or graphing calculators are prohibited. No other electronic devices will be permitted.**Quizzes:**a) Quizzes can consist of online, in-class announced/unannounced quizzes and/or take home quizzes (assignments). b) Attendance for classes is mandatory since unannounced quizzes can be given.c) Dates for announced quizzes will be communicated in class.d) There are no makeups for quizzes missed or extension of deadlines for online

quizzes.

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c) Dates for announced quizzes will be communicated in class.

d) There are no makeups for quizzes missed or extension of deadlines for online quizzes.

**Attendance**:

Students are required to maintain a 70% attendance level in order to be eligible to complete any course recovery options.

# Course Policies

Students who did not pass either the Linear Algebra or the Statistics portion of the course will be eligible to write one Supplemental Test on the failed portion (to be written by the Wednesday of Week 15) subject to the conditions:

a) the student has achieved no lower than 46% on the failing portion.

b) the overall mark is 50% or better.

If the student passes the Supplemental Test, they will keep their original mark.

# College Policies

Students should familiarize themselves with all College Policies that cover academic matters and student conduct.

All students and employees have the right to study and work in an environment that is free from discrimination and harassment and promotes respect and equity. Centennial policies ensure all incidents of harassment, discrimination, bullying and violence will be addressed and responded to accordingly.

Academic Honesty

Academic honesty is integral to the learning process and a necessary ingredient of academic integrity. Forms of academic dishonesty include cheating, plagiarism, and impersonation, among others. Breaches of academic honesty may result in a failing grade on the assignment or course, suspension, or expulsion from the college. Students are bound to the College's AC100-11 Academic Honesty and Plagiarism policy.

To learn more, please visit the Libraries information page about Academic Integrity https://libraryguides.centennialcollege.ca/academicintegrity and review Centennial College's Academic Honesty Module:
https://myappform.centennialcollege.ca/ecentennial/articulate/Centennial_College_Academic_Integrity_Module_%202/story.html

Use of Lecture/Course Materials

Materials used in Centennial College courses are subject to Intellectual Property and Copyright protection, and as such cannot be used and posted for public dissemination without prior permission from the original creator or copyright holder (e.g., student/professor/the College/or third-party source). This includes class/lecture recordings, course materials, and third-party copyright-protected materials (such as images, book chapters and articles). Copyright protections are automatic once an original work is created, and applies whether or not a copyright statement appears on the material. Students and employees are bound by College policies, including AC100-22 Intellectual Property, and SL100-02 Student Code of Conduct, and any student or employee found to be using or posting course materials or recordings for public dissemination without permission and/or inappropriately is in breach of these policies and may be sanctioned.

For more information on these and other policies, please visit www.centennialcollege.ca/about-centennial/college-overview/college-policies.

Students enrolled in a joint or collaborative program are subject to the partner institution's academic policies.

# PLAR Process

This course is eligible for Prior Learning Assessment and Recognition (PLAR). PLAR is a process by which course credit may be granted for past learning acquired through work or other life experiences. The PLAR process involves completing an assessment (portfolio, test, assignment, etc.) that reliably demonstrates achievement of the course learning outcomes. Contact the academic school to obtain information on the PLAR process and the required assessment.

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| Semester: | Fall 2021 | Professor Name: | SAMIR MANSUR |
| Section Code: | 005 | Contact Information: | smansur1@my.centennialcollege.ca |
| Meeting Time & Location: | Wednesday 9:30 am - 11:20 am Online | Last Date to Drop Course: | 11/12/2021 |
| Delivery Method: | Online (Blended) | | |

## Topical Outline (subject to change):

| Week | Topics | Readings/Materials | Weekly Learning Outcome(s) | Instructional Strategies | Evaluation Name and Weight | Evaluation Date |
|---|---|---|---|---|---|---|
| 1 | 1. Systems of Linear Equations | Unit 1 - LA textbook | 1.1 Distinguish between types of solutions for linear systems<br>1.2 Use row operations (Gaussian elimination) to solve systems of linear equations | Lecture, sample problems, pair practice | | |
| 2 | 2. Matrix Operations | Unit 2 - LA textbook | 2.1 Perform basic matrix operations involving different size matrices.<br>2.2 Apply algebraic properties of matrices in questions involving matrix operations. | Lecture, sample problems, demonstrations using linear algebra software | | |
| 3 | 3. Inverse of a matrix | Unit 3 - LA textbook | 3.1 Compute the inverse of a 2x2 matrix by use of formula<br>3.2 Use row operations to find the inverse of a 3x3 matrix<br>3.2 Solve a linear system by matrix inversion | Lecture, sample problems,demonstrations using linear algebra software, pair work | | |
| 4 | 4.Special matrices. The determinant and Cramer's rule. The adjoint theorem. | Unit 4 - LA textbook | 4.1 Apply properties of special matrices to perform operations with matrices.<br>4.2 Calculate determinants by using cofactor expansion.<br>4.3 Apply Cramer's rule to solve systems of linear equations.<br>4.4 Calculate the inverse of a matrix by using the adjoint theorem | Lecture, examples,demonstrations using linear algebra software, assigned questions, individual practice | Assignment 1 (10%) | |
| 5 | 5. Vectors in 2, 3 and n-Space, The Norm of a vector, The Dot product | Unit 5 & 6.1 - LA textbook | 5.1 Perform operations using vector components<br>5.2 Calculate the norm of a vector<br>5.3 Compute the dot product of two vectors | Lecture, examples, individual practice | Quiz 1 (15%) | |
| 6 | 6. Orthogonality & Cross product | Unit 6: 6.2, 6.3 & 6.4 - LA textbook | 6.1 Compute vector components along another vector and orthogonal to another | Sample problems; Think, pair, share | | |

| Week | Topics | Readings/Materials | Weekly Learning Outcome(s) | Instructional Strategies | Evaluation Name and Weight | Evaluation Date |
|------|--------|--------------------|----------------------------|--------------------------|----------------------------|-----------------|
| | | | vector<br>6.2 Calculate areas determined by two vectors by use of the cross product<br>6.3 Use the scalar triple product to conclude whether three given vectors are collinear | | | |
| 7 | Review for Test 1 | Use Supplemental Package for test review | Solve questions related to topics 1 - 6 | Assigned questions, Small group work, Class discussion | Test 1 (25%) | |
| 8 | 8. Graphic Representations of data sets & Measures of Central Tendency, Position, and Dispersion | Statistics textbook: Unit 1 & Unit 2 | 8.1 Describe data using graphic representations<br>8.2 Organize and summarize data by use of measures of central tendency, position and dispersion | Lecture, examples, demonstrations using Statistical software, individual practice | | |
| 9 | 9. Descriptive Methods for Bivariate Data<br>- The Least Squares Regression Line<br>- The Linear Correlation Coefficient | Statistics textbook: Unit 3 | 9.1 Determine an equation to describe the relationship between two variables.<br>9.2 Analyze the relationship between two variables (calculate the coefficients of correlation and determination) | Lecture, demonstrations using statistical software, small group practice | | |
| 10 | 10. Discrete probability distributions. Binomial distribution Continuous probability distributions. Normal distribution and the Standard Normal. | Statistics textbook: Unit 4 & Unit 5: 5.1 & 5.2 | 10.1 List properties of discrete probability distributions<br>10.2 Calculate the mean, variance and standard deviation of discrete probability distributions (including the binomial distribution).<br>10.3 Solve problems involving binomial distributions.<br>10.4 List properties of continuous probability distributions.<br>10.5 Compute z- values and determine probabilities by using z-tables. | Lecture, examples, assigned questions, class discussion | | |
| 11 | 11. Central Limit Theorem Statistical inference. Estimating population mean. | Statistics textbook: Unit 5: 5.3 & Unit 6: 6.1 & 6.2 | 11.1 Apply Central Limit Theorem to find probabilities based on sample means.<br>11.2 Compute t-values and determine probabilities using t-tables.<br>11.3 Construct confidence intervals for a population mean. | Lecture, demonstrations using computer simulations, small group practice | Assignment 2 (10%) | |

| Week | Topics | Readings/Materials | Weekly Learning Outcome(s) | Instructional Strategies | Evaluation Name and Weight | Evaluation Date |
|---|---|---|---|---|---|---|
| 12 | 12. Hypothesis testing - population mean | Statistics textbook: Unit 6: 6.4 & 6.5 | 12.1 Explain critical values, level of significance and difference between two-tailed and one-tailed tests.<br>12.2 Perform hypothesis testing about a population mean and interpret the results. | Lecture, sample problems, assigned questions, pair work | Quiz 2(15%) | |
| 13 | 13 Statistical inference. Estimating population proportion. Hypothesis testing-population proportion. | Statistics textbook: Unit 6: 6.3 & 6.6 | 13.1 Construct confidence intervals for a population proportion.<br>13.2 Perform hypothesis testing about a population proportion and interpret the results. | Lecture, sample problems, assigned questions, small group practice | | |
| 14 | 14. Review for Test 2 | Use Supplemental Package for Test review | 14. Solve questions related to topics 8-13. | Assigned questions, small group work, class discussion | Test 2 (25%) | |