Course Outline

School:	Eng. Tech. & Applied Science
Department:	Information and Communication Engineering Technology (ICET)
Course Title:	Introduction to AI
Course Code:	COMP 237
Course Hours/Credits:	56
Prerequisites:	COMP 123, MATH 175, MATH 185
Co-requisites:	MATH 210
Eligible for Prior Learning, Assessment and Recognition:	Yes
Originated by:	mayy habayeb
Creation Date:	Summer 2020
Revised by:	Ilia Nika
Revision Date:	Fall 2020
Current Semester:	Fall 2021
Approved by:	*ppesikan c/o*

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Chairperson/Dean

Students are expected to review and understand all areas of the course outline.

Retain this course outline for future transfer credit applications. A fee may be charged for additional copies.

This course outline is available in alternative formats upon request.

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

In this course, students will be introduced to the history and fundamental concepts of artificial intelligence. Coursework will emphasize types of artificial intelligence, search algorithms, basic machine learning algorithms and ethical aspects of AI.

Program Outcomes

Successful completion of this and other courses in the program culminates in the achievement of the Vocational Learning Outcomes (program outcomes) set by the Ministry of Colleges and Universities in the Program Standard. The VLOs express the learning a student must reliably demonstrate before graduation. To ensure a meaningful learning experience and to better understand how this course and program prepare graduates for success, students are encouraged to review the Program Standard by visiting http://www.tcu.gov.on.ca/pepg/audiences/colleges/progstan/. For apprenticeship-based programs, visit http://www.collegeoftrades.ca/training-standards.

Course Learning Outcomes

The student will reliably demonstrate the ability to:

1. Explain the fundamental concepts, goals, and applications of AI.
2. Explain the concept and structure of intelligent agents and the various environments they operate in.
3. Explain the concept of problem solving and implement various search algorithms (DFS,BFS, UCS, Greedy search & A*) to solve search problems.
4. Define machine learning and explain the types of learning problems.
5. Code, apply & test machine learning algorithms to solve problems and create predictive models (Linear regression, logistic regression, Naive Bayes, simple neural networks, Mean shift and CAM shift clustering).
6. Define natural language processing and implement simple NLP algorithms to classify text.
7. Explain the main concepts of computer vision and its applications.
8. Explain the social and ethical implications of AI applications faced by software engineers.
9. Evaluate AI tools and techniques used for designing software solutions for a variety of business problems.

Essential Employability Skills (EES)

The student will reliably demonstrate the ability to*:

1. Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.
2. Respond to written, spoken, or visual messages in a manner that ensures effective communication.
3. Execute mathematical operations accurately.
4. Apply a systematic approach to 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

Methods of Instruction

Engaging and interactive lecture content.

Lab demonstrations and tutorials.

Hands on practical lab exercises.

Interactive discussion forms and boards.

Team project.

Text and other Instructional/Learning Materials

Text Book(s):

1.Artificial intelligence a modern approach by Stuart J. Russell and Peter Norvig, forth edition Published by Pearson Education, Inc. ISBN-13: 978-0-13-461099-3 ISBN-10: 0-13-461099-7

2.Hands-On Artificial Intelligence for Search by Devangini Patel Published by Packt Publishing, 2018 ISBN: 978-1-78961-115-1

3.Python: Advanced Predictive Analytics, by Joseph Babcock and Ashish Kumar. Published by Packt Publishing Ltd ISBN: 9781788992367.(12/2017)

4.Artificial Intelligence with Python second edition by Alberto Artasanchez, Prateek Joshi Published by Packt Publishing, 2020 ISBN: 9781839219535

Especial credit to UC Berkeley CS188 Intro to AI

Online Resource(s):

http://aima.cs.berkeley.edu/

https://www.anaconda.com/

https://scikit-learn.org/0.19/index.html

https://www.nltk.org/

https://opencv.org/

Material(s) required for completing this course:

Textbook plus online resources specified in course shell Topicals

Evaluation Scheme

⇨ Test number one midterm: Written and hands on test material weeks 1 to 6

⇨ test number two (final): Theory & Practical hands on

⇨ Quizzes: two quizzes week 5 and week 10 each worth 5%

⇨ Lab assignments: Five lab assignments throughout the course:

1.Agents

      2.Search

      3.Linear regression

      4.Logistic regression

      5.Neural Networks

⇨ On-line participation: Participating on the discussion board discussions effectively

⇨ Group project assignment: Students will work in groups to build a proposal for an AI project supported by code for a business problem

Evaluation Name	CLO(s)	EES Outcome(s)	GCE Outcome(s)	Weight/100
Test number one midterm	1, 2, 3, 4	4		20
test number two (final)	1, 4, 5, 6, 7, 8, 9	2, 3, 4		20
Quizzes	1, 2, 3, 4, 6, 7, 8	1, 2, 3		10
Lab assignments	3, 5, 6, 9	1, 4		25
On-line participation	1, 2, 7, 8	1, 2		10
Group project assignment	4, 5, 9	1, 2, 4		15
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

- Any dictionary (hard copy or electronic) may be used in regular class work.

Program or School Policies

N/A

Course Policies

N/A

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 are bound by College policies, including AC100-22 Intellectual Property, and SL100-02 Student Code of Conduct, and any student 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:	See e-centennial course shell
Section Code:	All	Contact Information:	See eCentennial course shell
Meeting Time & Location:	See myCentennial timetable	Delivery Method:	Online

Topical Outline (subject to change):

Week	Topics	Readings/Materials	Weekly Learning Outcome(s)	Instructional Strategies	Evaluation Name and Weight	Evaluation Date
1	Course Overview. The definition/foundation of Artificial intelligence (AI). AI Applications. AI Risks. Review of python.	Chapter 1 AI a modern approach (Rusell)	Explain and discuss the definition of artificial intelligence. List various applications of AI. Explain AI risks. Build simple scripts in python.	Lecture videos On-line lab tutorial videos. Discussion boards.	N/A	
2	Intelligent agents (definition, structures). The nature of environments.	Chapter 2 AI a modern approach (Rusell & Norveg)	Explain the concept of intelligent agents. Explain and discuss the difference between different intelligent agent types. Explain the various types of environments and how they differ from each other.	Lecture videos. On-line lab tutorial videos. Discussion boards.	N/A	
3	Problem solving using search. Representing the search problem (Trees & graphs). Uniformed search (blind search). Depth first search DFS. Breadths first search BDS. Data structures (stack,queue, graph)	Chapter 3 AI a modern approach (Rusell & Norveg). Chapters 1& 2 Hands-On Artificial Intelligence for Search by Devangini	Understand the concept of problem solving. Explain the concept of uninformed search. Build code a tree data structure. Build the code for a simple goal based intelligent agent. Design, code and test scripts that utilizes the DFS algorithm to solve problems. Build code scripts for a graph data structure. Design, code and test scripts that utilize the BDS algorithm to solve problems.	Lecture videos On-line lab tutorial videos. Discussion boards.	Lab assignment#1 "Agents" is due.	Week 3
4	Informed search. Heuristic functions. Uniform cost search UCS. Priority queues data structure. Greedy search first.	Chapter 3 AI a modern approach (Rusell & Norveg). Chapters 3 & 4 Hands-On Artificial Intelligence for Search by Devangini	Explain the concept of Informed search algorithms and heuristic concepts. Detail the steps required for local search, Greedy search and A* algorithm. Design, code and test scripts that utilizes the greedy & A* search algorithm to solve problems.	Lecture videos On-line lab tutorial videos. Discussion boards.	N/A	

Week	Topics	Readings/Materials	Weekly Learning Outcome(s)	Instructional Strategies	Evaluation Name and Weight	Evaluation Date
	A* algorithm.		Explain and discuss the differences of search strategies.			
5	Machine learning overview. Supervised machine learning. Feature Engineering. Classification and regression. Review statistical Concepts. Basic data information. Linear regression (Math and code).	Chapter 19 AI a modern approach (Rusell & Norveg). Python: Advanced predictive analytics. Chapters 3 & 4 Python: Advanced Predictive Analytics, by Joseph Babcock and Ashish Kumar.	Explain the concept of machine learning. Explain the types of learning. Explain Probability density functions, Z-test, P-test & chi square tests & correlation. Explain the math/logic. behind linear regression models and model evaluation. Design code, test and evaluate linear regression models. Explain the concept of loss functions in machine learning.	Lecture videos. On-line lab tutorial videos. Discussion boards.	Quiz #1. Lab assignment #2 "Search" due.	week 5
6	Data pre-processing. Logistic regression math and code. Classification models evaluation. Evaluation metrics (Confusion matrix).	Chapter 19 AI a modern approach (Rusell & Norveg). Chapters 2,6 & 7: Python: Advanced Predictive Analytics (Babcock and Ashish)	Generate simple plots like scatter, bar charts, histograms, box plots. Design code scripts to: slice,dice datasets.Convert continuous attributes into categorical. Normalize/ scale attributes. Explain the math/logic behind Logistic regression. Design, code, test and evaluate logistic regression models.	Lecture videos On-line lab tutorial videos. Discussion boards.	Lab assignment # 3 "Linear regression" is due.	week 6
7	Review Tests	Week 1 - week 6 online material	Test #1	Test #1.	Test #1. Lab Assignment #4 "Logistic regression" is due.	week 7
8	Artificial Neural networks. Linear classifiers. Types and structures of Neural networks. Perceptron based classifiers. Activation functions. Gradient decent.	Chapter 19 AI a modern approach (Rusell & Norveg)	Explain the concept of Neural networks. Explain the concept of linear classifiers. Explain the concept of a perceptron classifier. Explain the concept of gradient descent algorithm. Design code, test and evaluate a perceptron.	Lecture videos On-line lab tutorial videos. Discussion boards.	N/A	

Week	Topics	Readings/Materials	Weekly Learning Outcome(s)	Instructional Strategies	Evaluation Name and Weight	Evaluation Date
9	Multilayer feed-forward neural networks. Back propagation algorithm.	Chapter 21 AI a modern approach (Rusell & Norveg). Chapter 19 AI with Python second edition (Joshi & Artasanchez)	Explain the concept of feed forward networks with hidden layers. Explain the back propagation algorithm. Design code, test and evaluate single and multi layer feed forward neural network models.	Lecture videos On-line lab tutorial videos. Discussion boards.	N/A	
10	Natural language processing (NLP). Text pre-processing. Bayes Theorem. Term Frequency - Inverse Document Frequency (tf-idf).	Chapter 23 AI a modern approach (Rusell & Norveg) Chapter 15 Artificial Intelligence with Python second edition (Joshi & Artasanchez)	Explain the main natural language concepts. Develop scripts to remove punctuation and stop words. Develop scripts to tokenize and convert words to their base forms using stemming. Develop scripts to create chunks from corpus's of text and create bags of works. Explain the math logic behind Bayes theorem.	Lecture videos. On-line lab tutorial videos. Discussion boards.	Quiz # 2. Lab Assignment # 5 "Neural networks" is due	Week 10
11	Language models Text Classification (using Naïve Bayes) Text corpuses	Chapter 23 AI a modern approach (Rusell & Norveg) Chapter 15 Artificial Intelligence with Python second edition (Joshi & Artasanchez)	Discuss and explain language models: •Bag of words •N grams Build a naïve Bayes text classifier.	Lecture videos On-line lab tutorial videos. Discussion boards.		
12	Computer Vision Image processing Image features Frame differencing Clustering Mean shift clustering algorithm	Chapter 25 AI a modern approach (Rusell & Norveg) Chapter 18 Artificial Intelligence with Python second edition (Joshi & Artasanchez)	Explain how images and videos are stored and their main characteristics. Discuss the main application of computer vision. Explain the various color models RGB, HSV..etc. Explain clustering concept in machine learning and similarity measures. Explain the mean shift algorithm logic. Perform clustering analysis on the pixels of the image using mean shift clustering algorithm for object identification.	Lecture videos On-line lab tutorial videos. Discussion boards.		Week 12
13	The ethical aspects of AI	Chapter 27 AI a modern approach (Rusell & Norveg)	List and discuss the main concerns of AI technology from a safety and ethical point of view.	Lecture videos On-line lab tutorial videos. Discussion boards.	Project deliverable is due	week 13
14	Review Tests	Week 5 - week 13 online material	Test results	Test #2	Test #2	week 14