Course Outline

School:	Eng. Tech. & Applied Science
Department:	Information and Communication Engineering Technology (ICET)
Course Title:	Programming 3
Course Code:	COMP 212
Course Hours/Credits:	56
Prerequisites:	COMP 123
Co-requisites:	N/A
Eligible for Prior Learning, Assessment and Recognition:	Yes
Originated by:	Programming Languages Group
Creation Date:	Fall 2012
Revised by:	Yin Hua Li
Revision Date:	Winter 2025
Current Semester:	Fall 2025
Approved by:	

Clarence Cheung, Associate Dean/Dean
Eng. Tech. & Applied Science

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

The goal of this course is to enable students, already proficient in OOP, to build robust and more complex, data-driven desktop applications using the .NET technologies. Coursework emphasizes advanced topics, such as generics, extension methods, linear data structures, Delegate, asynchronous programming, parallel programming, advanced GUI, Entity Framework core, ML.NET framework, etc.. The language of instruction is C#.

External Standard Information (ESI)

N/A

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 https://www.skilledtradesontario.ca/about-trades/trades-information/.

Course Learning Outcomes

The student will reliably demonstrate the ability to:

1. Design, code, and test C# applications that apply classic data structures to minimize the memory and/or time required for common operations of insertion, access, search, modification, or removal.
2. Examine the use of delegates in C# apps, including implementation of callback methods and event handling
3. Improve the performance of C# applications by using asynchronous programming and parallel programming
4. Design, code and test WPF applications
5. Query and manipulate data in C# apps by using an open source, cross-platform data access technology, such as Entity Framework Core
6. Integrate various machine learning algorithms into C# applications.

Essential Employability Skills (EES)

The student will reliably demonstrate the ability to*:

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.
5. Use a variety of thinking skills to anticipate and solve problems.
11. Take responsibility for one's own actions, decisions, and consequences.

**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.*

New Essential Skills (NES)

N/A

Global Citizenship and Equity (GC&E) Outcomes

1. Identify one's roles and responsibilities as a global citizen in personal and professional life.
2. Identify beliefs, values and behaviours that form individual and community identities and the basis for respectful relationships.
3. Analyze issues of equity at the personal, professional, and global level.
4. Analyze the use of the world's resources to achieve sustainability and equitable distribution at the personal, professional, and global level.
6. Support personal and social responsibility initiatives at the local, national or global level.

Methods of Instruction

Interactive Lecture, demonstrations, hands-on lab sessions

Text and Other Instructional/Learning Materials

The costs of textbooks or other learning material are available through the Centennial College Bookstore https://www.bkstr.com/centennialprogressstore/shop/textbooks-and-course-materials.

Text Book(s):

Christian Nagel, Professional C# and .NET, 2021 Edition, Published by Wrox, ISBN-13: 978-1119797203, September 2021. Available at https://learning.oreilly.com/library/view/professional-c-and/9781119797203/

Ian Griffiths, Programming C# 12: Build Cloud, Web, and Desktop Applications, published by O'Reilly Media, ISBN-13: 978-1098158361, July 2024, available at https://learning.oreilly.com/library/view/programming-c-12/9781098158354/

Dino Esposito, Francesco Esposito, Programming ML.NET, published by Microsoft Press, March 2022, available at https://learning.oreilly.com/library/view/programming-ml-net/9780137383511/

Online Resource(s):

https://dotnet.microsoft.com/

Please see the weekly topical outline for any Additional Learning Resources required for your section of this course.

Classroom and Equipment Requirements

Computers with access to the Internet. Software image in Software engineering labs includes all tools used in this course.

Evaluation Scheme

- Lab 1: Develop C# applications that employ generic class, generic methods, collections, searching and sorting algorithms
- Lab 2: Develop C# applications using delegate
- Lab 3: Develop more responsive and faster C# WPF apps by using asynchronous programming and parallel programming
- Lab 4: Develop WPF applications with MVVM pattern to access and/or manipulate data in Database
- Lab 5: Develop C# applications using ML.NET framework
- Test 1 Hands-on: Test 1 will take place in week 7 and will cover material taught in weeks 1-6.
- Test 2 Hands-On: Test 2 will take place in week 14 and will cover material taught in weeks 7-13.

Evaluation Name	CLO(s)	EES Outcome(s)	NES Outcome(s)	GCE Outcome(s)	Weight/ 100
Lab 1	1	2, 3, 4, 5, 11		1, 2, 3, 6	10
Lab 2	2	2, 3, 4, 5, 11		1, 2, 3, 4, 6	10
Lab 3	3, 4	2, 3, 4, 5, 11		1, 2, 3, 4, 6	10
Lab 4	4, 5	2, 3, 4, 5, 11		1, 2, 3, 4, 6	10
Lab 5	6	2, 3, 4, 5, 11		1, 2, 3, 4, 6	10
Test 1 Hands-on	1, 2, 3, 4	2, 3, 4, 5, 11		1, 2, 3, 4, 6	25
Test 2 Hands-On	1, 4, 5, 6	2, 3, 4, 5, 11		1, 2, 3, 4, 6	25
Total					100%

If students are unable to write a test they should immediately contact their professor or program Associate Dean 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 College approved plagiarism prevention software. Students who do not wish to have their work submitted to College approved plagiarism prevention software 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, psycho-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

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 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.

Topical Outline (subject to change):

ORIGINAL TOPICAL

Week	Topics	Readings/Materials	Weekly Learning Outcome(s)	Instructional Strategies	Evaluation Name and Weight	Evaluation Date
1	Generics: Generic classes, Generic methods, Extension Methods	Chapter 5	. Explain boxing & unboxing . Explain generic Structs & generic interfaces . Explain type constraints . Describe generic classes & generic methods with type constraints . Describe extension methods . Implement/Use generic classes, generic methods, and extension methods in C# applications	Interactive lecture Demonstration Lab session		
2	Introduction to Linear Data structure	Chapter 8	.Define Linear Data structures .Examine Arrays, Lists (linked lists, doubly linked lists, circularly linked lists) . Perform CRUD operations on Arrays, Lists . Use Arrays and Lists in C# apps.	Interactive lecture Demonstration Lab session	Lab 1	Week 3
3	Stack & Queue	Chapter 8	Explain Stack's features and operations can be performed	Interactive lecture Demonstration Lab session		
4	Map, HashTable & Set	Chapter 8	. Examine dictionaries, sets, and hash tables. . Apply the operations that can be performed on dictionaries, sets, and hash tables. . Use dictionaries, sets, HashSet in C# apps	Interactive lecture Demonstration Lab session		
5	Delegates	Chapter 7	. Define and use delegate in C# Apps	Interactive lecture Demonstration Lab session	Lab 2	Week 6
6	Asynchronous Programming & Parallel programming	Chapter 11 & 17	. Use async and await keywords to implement asynchronous programming . Use Task-based Asynchronous Pattern to take advantage of multi-core processors . Differentiate between asynchronous programming and parallel programming . Use asynchronous programming and parallel programming together to develop more responsive and high performance C# applications	Interactive lecture Demonstration Lab lession	Lab 3	Week 8
7	WPF Applications	Chapter 29 & 30	. Explain features of WPF	Interactive lecture	Test 1	

Week	Topics	Readings/Materials	Weekly Learning Outcome(s)	Instructional Strategies	Evaluation Name and Weight	Evaluation Date
			. Define styles in XMAL. . Explain Data Binding . Develop WPF applications that utilize data binding	Demonstration Lab session		
8	Data Binding	Lecture Handout	. Use advanced data binding properties, such as Fallback, StringFormat, Converter, etc., to improve data presentation in WPF applications . Select appropriate WPF controls for a specified scenario . Implement WPF UserControl	Interactive lecture Demonstration Lab session		
9	Advanced WPF	Lecture Handout	. Implement WPF UserControl and consume it .Apply MVVM pattern to implement complex desktop applications	Interactive lecture Demomstration Lab session	Lab 4	Week 11
10	LINQ & Entity Framework Core	Chapter 21	. Use LINQ to access data from different data sources . Develop C# applications to create database by using Entity Framework Core . Use Entity Framework Core to generate data model classes from an existing database . Develop windows desktop applications to access and/or manipulate data in a Database by using LINQ and DbContext class	Interactive lecture Demonstration Lab session		
11	Entity Framework Core - Part 2	Lecture Handout	. Perform CRUD on data stored in Database using Entity Framework Core . Learn Command pattern . Develop Windows Desktop Applications to implement MVVM pattern and Command pattern	Interactive lecture Demonstration Lab session		
12 - 13	ML.NET Framework	Lecture Handout	. Identify different building blocks in a machine learning pipeline in ML.NET . Differentiate various transformations on different kinds of data . Identity and solve regression type of problems by using ML.NET supported regression trainers . Identify and solve classification type of problems by using trainers/classifiers provided in ML.NET . Describe how clustering algorithms work . Use ML.NET classes to integrate machine	Interactive lecture Demonstration Lab session	Lab 5	Week 13

Week	Topics	Readings/Materials	Weekly Learning Outcome(s)	Instructional Strategies	Evaluation Name and Weight	Evaluation Date
			learning into C# apps			
14	Test 2	Week 7-13 materials	Week 7-13 learning outcomes	Hands-on test	Test 2	Week 14