

SENECA COLLEGE OF APPLIED ARTS AND TECHNOLOGY

FACULTY OF CONTINUING EDUCATION AND CONTRACT TRAINING

ADULT ACADEMIC UPGRADING / COLLEGE PREPARATORY PROGRAM

SUBJECT OUTLINE

ACE TECHNICAL MATHEMATICS-12U

MTH092-12U

SUBJECT DESCRIPTION:

This course provides students with the mathematical skill needed to solve technical and scientific problems. It builds on the algebraic skills mastered in previous mathematics courses, developing algebraic and trigonometric strategies that will provide the means to arrive at solutions in a structured, dependable way. **Topics from MCB4U high-school course have been included so that this course meets the admission requirements for a grade 12(U) course.** Students will be able to apply their skills to solve applied problems involving trigonometry and polynomial/rational/exponential expressions and to analyze polynomial/exponential/logarithmic/trigonometric functions. Upon successful completion of this course, students may apply for admission to **college and university programs that require grade 12U credits.**

GENERAL LEARNING OUTCOMES

Upon the successful completion of this course, the student will be able to

1. Use Computation and Algebraic Manipulation to simplify algebraic expressions and solve equations
2. Analyse models and graphs of various functions, including quadratic, trigonometric, exponential, logarithmic functions
3. Solve problems involving trigonometry, radicals and complex numbers
4. Use modeling to solve various applications, **including optimization and related-rates problems**
5. **Determine the derivatives of polynomial, rational, and exponential functions**
6. **Analyze and sketch functions, using differential calculus**

SPECIFIC LEARNING OUTCOMES:

Computation and Algebraic Manipulation

- Use laws of algebra to simplify algebraic expressions (including exponents, polynomials, algebraic fractions, and radicals)
- Factor polynomials
- Create and solve quadratic, rational, and radical equations
- Rearrange formulae for a specific subject

Functions and Graphs

- Demonstrate facility in the use of function notation to represent a function and its inverse
- Sketch the graphs of various functions including quadratic, exponential, logarithmic and trigonometric functions.
- Construct graphs and formulas to represent direct and inverse variation
- Determine and interpret the rates of change of functions drawn from the natural and social sciences;

Trigonometry

- Use radian measure in solving equations and in graphing.
- Prove simple identities by applying the Pythagorean identity and the quotient relation
- Solve problems using the sine and cosine laws in right, acute and oblique triangles

Complex Numbers

- Understand and perform operations with complex numbers.

Logarithms

- Convert logarithmic functions to exponential form and vice versa
- Simplify and evaluate logarithmic expressions
- Demonstrate an understanding of exponential growth and decay.

Problem Solving/Modeling

- Translate word statements to quadratic, rational, radical, exponential, logarithmic and trigonometric equations
- Apply mathematical concepts to solve a variety of problems in various fields of study

Derivatives and Applications

- Use the graphical definition, the first-principles or the derivation rules to calculate the derivative of a function
- Sketch the graphs of polynomial, rational, and exponential functions using derivatives
- Use calculus techniques to solve applications, including rates of change and optimization problems involving polynomial and rational functions

PREREQUISITES:

MTH 080 with a grade of at least “B” or approval following appraisal of an Adult Academic Upgrading / College Preparatory (AAUCP) math intake test written at the College.

CREDIT STATUS:

This is a full credit for the Academic and Career Entrance (ACE) Technical Mathematics
This course is designed according to the Academic and Career Entrance Program (ACE) approved by the Ontario Ministry of Training, Colleges and University. Upon completion of MTH092 students will satisfy the mathematics entry requirements for **applied degree** programs.

MODES OF INSTRUCTION:

The instructional methods of this course are composed of independent study, one-on-one or small group teaching, and board demonstration. Students may self-assess their skills using

module reviews. The estimated time needed for completing this course through self-paced learning is 36 weeks.

REQUIRED TEXTS:

Beginning & Intermediate Algebra by Miller and O’Neill, McGraw-Hill, ISBN 0-07-296533-9
Introduction to Technical Mathematics, 4th ed., by Washington and Triola, The Benjamin/Cummings Publishing Co., ISBN: 0-8053-9538-5

Advanced Functions and Introductory Calculus by Malinowski et al., Thompson Nelson, ISBN970-0-7747-1454-9

Note: There is a fully refundable deposit of \$100.00 for the loan of program textbooks.

REFERENCE MATERIAL:

Practice unit demonstrations and final demonstrations with answers are available from your teacher.

REQUIRED SUPPLIES:

3-ring binder, loose-leaf paper, pencil, eraser, ruler. calculator

Note: A calculator is permitted for MTH097 unit demonstrations and final demonstration.

TOPIC OUTLINE:

Polynomials and properties of exponents

Exponents: Multiplying and Dividing Common Bases

More Properties of Exponents

Definitions of b^0 and b^{-n}

Addition and Subtraction of Polynomials

Multiplication of Polynomials

Division of Polynomials

Factoring Polynomials

Greatest Common Factor and Factoring by Grouping

Factoring Trinomials: Grouping Method

Factoring Trinomials: Trial-and-Error Method

Factoring Perfect Square Trinomials and the Difference of Squares

Factoring the Sum and Difference of Cubes

General Factoring Summary

Solving Quadratic Equations Using the Zero Product Rule

Rational Expressions

Introduction to Rational Expressions

Multiplication and Division of Rational Expressions

Least Common Denominator

Addition and Subtraction of Rational Expressions

Complex Fractions
Rational Equations
Applications of Rational Equations and Proportions

Introduction to Relations and Functions

Introduction to Relations
Introduction to Functions
Graphs of Basic Functions
Variation

Radicals and Complex Numbers

Definition of an n th-Root
Rational Exponents
Properties of Radicals
Addition and Subtraction of Radicals
Multiplication of Radicals
Rationalization
Radical Equations
Complex Numbers

Quadratic Functions

Square Root Property and Completing the Square
Quadratic Formula
Equations in Quadratic Form
Graphs of Quadratic Functions
Applications of Quadratic Functions

Exponential and Logarithmic Functions

Algebra and Composition of Functions
Inverse Functions
Exponential Functions
Logarithmic Functions
Properties of Logarithms
The Irrational Number e
Exponential and Logarithmic Equations

Trigonometry

The Trigonometric Ratios
Values of the Trigonometric Ratios
Right Triangle Applications
Signs of the Trigonometric Functions
Values of the Trigonometric Functions of Any Angle
The Law of Sine
The Law of Cosine

Introduction to Calculus

The Slope of a Tangent
Rates of Change
The Limit of a Function
Properties of Limits
Continuity

Derivatives

The Derivative Function
The Derivatives of Polynomial Functions
The Product Rule
The Quotient Rule
The Derivative of a Composite Function

Applications of Derivatives

Implicit Differentiation
Related Rates
Maximum and Minimum on an Interval
Optimization Problems

Derivatives of Exponential and Logarithmic Functions

Derivatives of Exponential Functions
The Derivative of the Natural Logarithmic Function
Optimization Problems

PROMOTION POLICY

Completion of MTH092 within 36 weeks with a grade of “B” is recommended. A grade of “D” or better is necessary for successful completion of this course. If you are applying for admission to college or university, you should be striving for an A.

GRADING POLICY:

A +	Distinguished	90% - 100%
A	Excellent	80% - 89%
B+	Above Average	75% - 79%
B	Average	70% - 74%
C +	Below Average	65% - 69%
C	Satisfactory	60% - 64%
D	Pass	55% - 59%
F	Unsatisfactory	0% - 54%

MODE OF EVALUATION:

Students have to write a demonstration after completing each unit of study and a final demonstration that covers all topics studied. In order to pass the course, students have to score a minimum of 55% for each module demonstration and for the comprehensive final exam.

The final grade will be calculated as follows:

<i>Average of all modules</i>	<i>70%</i>
<i>Comprehensive Final Exam</i>	<i><u>30%</u></i>
<i>Total</i>	<i>100%</i>

To successfully complete this course, students must:

1. Achieve an average of 55% or more on the unit demonstrations
2. Achieve a mark of 55% or more on the final demonstration

Students who do not satisfy conditions “1.” and “2.” as explained above will receive an “F”

Note: Students are encouraged to rewrite, after reviewing the material, any demonstration in which they have obtained a mark of less than 60%. In this case the two unit demonstrations will be averaged to determine the mark for the corresponding unit of study. However, the final mark for the demonstration that has to be rewritten cannot be higher than 70%. The same policy applies to the rewriting of the final demonstration.

LANGUAGE STANDARDS:

Classroom exercises and homework marked by the teacher will be evaluated for standards of language use in addition to content. Exercises, which contain grammatical, spelling, or other errors of language use will be returned for correction.

CHEATING AND PLAGIARISM:

Cheating and plagiarism are major academic offences and carry serious penalties. First offence: A student caught cheating will receive a mark of “0” “on the work in which the offence occurred” and have a comment indicating cheating listed on their transcript. This comment will be removed upon graduation. Second or subsequent offence: “The penalty for the second offence of cheating or plagiarism is immediate expulsion from the college for the remainder of the semester or longer, depending on the circumstances.” The comment will remain on the student’s transcript and will not be removed upon graduation. Students are referred to College Policy on “Cheating and Plagiarism” in the College Academic Policy http://www.senecac.on.ca/home/academic_policy/.

POLICY ON DISCRIMINATION/HARASSMENT:

All students and employees have the right to study and work in an environment that is free from discrimination and/or harassment. Language or activities that defeat this objective violate the College Policy on Discrimination/Harassment and shall not be tolerated. Information and assistance are available from the Resolution, Equity and Diversity Centre (REDC) at Newnham Campus, room 3015, tel. (416) 491-5050 ext. 2078 or via email at Human.Rights@senecac.on.ca.

Approved by:

Leolyn Hendricks, Chair/ Principal, York Gate Campus,
Faculty of Continuing Education and Training
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