

**SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY  
SAULT STE MARIE, ON**



**COURSE OUTLINE**

**Course Title: Calculus**

**Code No.: Mth 577-4**

**Semester: Four**

**Program: Electrical / Electronics / Computer Technology**

**Author: The Mathematics Department**

**Date: August 1998**

**Previous Outline Dated: July 1997**

Approved A. Azim MO  
Dean Date

*J. Morris*

**Total Credits: 4 Prerequisite(s): Mth 551**

**Substitutes: Mth 367, Mth 578**

**Length of Course: 4 hrs./week Total Credit Hours: 64**

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## **I. COURSE DESCRIPTION:**

This advanced course in calculus contains some special methods of integration, Maclaurin, Taylor and Fourier series, various types of first and second order differential equations, an introduction to Laplace transforms, and applications to the electrical/electronics area.

## **II. STUDENT PERFORMANCE OBJECTIVES:**

The basic objectives are that the student develop an understanding of the methods studied, demonstrate a knowledge of the facts presented and show an ability to use these in the solution of problems. To accomplish these objectives, exercises are assigned. Test questions will be of near equal difficulty to questions assigned in the exercises. The level of competency demanded is the level required to obtain an overall passing average on the tests. The material to be covered is listed below.

After studying each of the following topics, the student should be able to:

### Topic 1:

1. Integrate any type of algebraic or transcendental function using the general power formula for integration.
2. Find integrals of some types of expressions using a short table of integrals.
3. Find integrals of some expressions leading to a natural logarithm form using integration tables.
4. Evaluate integrals of some exponential expressions using a table of integrals.
5. Evaluate integrals of some trigonometric functions using a table of integrals.
6. Find integrals of some other types of trigonometric functions using integration tables.
7. Find integrals of some algebraic functions leading to inverse trigonometric functions using integration tables.
8. Find integrals of expressions requiring the use of the integration by parts formula. Some of these Integrals are also found in integration tables.
9. Find integrals of expressions requiring a trigonometric substitution. Some of these integrals are also found in integration tables.

### Topic 2:

1. Recognize the difference between convergent and divergent series.
2. Expand a function using a Maclaurin series.
3. Find a Maclaurin series for a function using a known Maclaurin series, by substitution, integration or differentiation, multiplication or division.
4. Compute numerical values using a Maclaurin series.
5. Expand a function using a Taylor series and then compute numerical values with this series.
6. Find a Fourier series for some types of periodic waveforms.

## II. STUDENT PERFORMANCE OBJECTIVES (Continued):

### Topic 3:

1. Identify a first order differential equation, and check a given solution to a differential equation.
2. Solve a first order differential equation by separating variables before integration.
3. Solve a first order differential equation by rearranging to isolate some form of integrable combination.
4. Find a solution (general or particular) for linear first order differential equations.
5. Solve some types of word problems involving differential equations.

### Topic 4:

1. Identify a higher order differential equation, and solve any type requiring direct integration.
2. Solve homogeneous differential equations where the auxiliary equation has unequal real roots.
3. Solve homogeneous differential equations where the auxiliary equation has equal (repeated) or complex roots.
4. Solve non-homogeneous differential equations combining a complementary and particular solution.
5. Solve some types of word problems involving higher order differential equations.
6. Find Laplace transforms of algebraic and transcendental functions and derivatives.
7. Use Laplace transforms to solve some types of differential equations.

1. TOPICS TO BE COVERED:	Approximate Time Frame
1. Methods of Integration	25 periods
2. Expansion of Functions in Series	15 periods
3. Differential Equations	20 periods

IV. LEARNING ACTIVITIES:

TOPIC NUMBER	TOPIC DESCRIPTION	REFERENCE CHAPTER ASSIGNMENTS
1.0	METHODS OF INTEGRATION	Chapter 28
1.1	The general power formula	All questions Page 796
1.2	The basic logarithmic form	All questions Page 800
1.3	The exponential form	All questions Page 803
1.4	Basic trigonometric forms	All questions Page 806
1.5	Other trigonometric forms	All questions Page 810
1.6	Inverse trigonometric forms	All questions Page 814
1.7	Integration by parts	All questions Page 818
1.8	Integration by trigonometric substitution	All questions Page 821
1.9	Integration by partial fractions	All questions Page 929 & 934
1.10	Integration by use of tables	All questions Page 823
1.11	Review exercise	All questions Page 825
2.0	EXPANSION OF FUNCTIONS IN SERIES	Chapter 29
2.1	Infinite series	All questions Page 830
2.2	Maclaurin series	All questions Page 835
2.3	Certain operations with series	All questions Page 839
2.4	Computations by use of series expansions	All questions Page 843
2.5	Taylor's series	All questions Page 846
2.6	Fourier series	All questions Page 853
2.7	Review exercises	All questions Page 855

**IV. LEARNING ACTIVITIES (Continued):**

<b>TOPIC NUMBER</b>	<b>TOPIC DESCRIPTION</b>	<b>REFERENCE CHAPTER ASSIGNMENTS</b>
<b>3.0</b>	FIRST ORDER DIFFERENTIAL EQUATIONS	Chapter 30
<b>3.1</b>	Solutions of differential equations.	All questions Page 859
<b>3.2</b>	Separation of variables	All questions Page 863
<b>3.3</b>	Integrable combinations	All questions Page 865
<b>3.4</b>	Linear first order DE	All questions Page 868
<b>3.5</b>	Elementary applications	All questions Page 872
<b>4.0</b>	HIGHER ORDER DIFFERENTIAL EQUATIONS	Chapter 30
<b>4.1</b>	Homogeneous equations with constant coefficients	All questions Page 878
<b>4.2</b>	Auxiliary equations with repeated or complex roots	All questions Page 881
<b>4.3</b>	Solutions of nonhomogeneous equations	All questions Page 885
<b>4.4</b>	Applications of second-order differential equations	All questions Page 891
<b>4.5</b>	Laplace transforms	All questions Page 895
<b>4.6</b>	Solving differential equations by Laplace transformers.	All questions Page 898
<b>4.7</b>	Review exercise	All questions Page 900

**V. REQUIRED RESOURCES / TEXTS / MATERIALS:**

1. Text: Washington, "Basic Technical Mathematics With Calculus", Sixth Edition, Metric Version. Benjamin/Cummings Pub. Co 1990.
2. Calculator: (Recommended) SHARP Scientific Calculator EL-531G. The use of some kinds of calculators may be restricted during tests.

## VI. EVALUATION PROCESS/GRADING SYSTEM:

### MAJOR ASSIGNMENTS AND TESTS

While regular tests will normally be scheduled and announced beforehand, there may be an unannounced test on current work at any time. Such tests, at the discretion of the instructor, may be used for up to 30% of the overall mark.

At the discretion of the instructor, there may be a mid-term exam and there may be a final exam, each of which can contribute up to 30% of the overall mark.

The instructor will provide you with a list of test dates. Tests may be scheduled out of regular class time.

### ATTENDANCE

It is your responsibility to attend all classes during the semester. Research indicates there is a high correlation between attendance and student success.

If you are absent from class, it is your responsibility to find out what work was covered and assigned and to complete this work before the next class. Your absence indicates your acceptance of this responsibility.

**Unexcused absence from a test may result in a mark of zero ("0").** Absence may be excused on compassionate grounds such as verified illness or bereavement. On return from an excused absence, you should ask your instructor to schedule the writing of a make-up test. Failure to do so will be considered as an unexcused absence.

### METHOD OF ASSESSMENT (GRADING METHOD)

A+	Consistently outstanding	(90% - 100%)
A	Outstanding Achievement	(80% - 89%)
B	Consistently above average achievement	(70% - 79%)
C	Satisfactory or acceptable achievement in all areas subject to assessment	(55% - 69%)
X or R	A temporary grade, limited to situations with extenuating circumstances, giving a student additional time to complete course requirements <b>(See below)</b>	(45% - 54%)
R	Repeat - The student has not achieved the objectives of the course, and the course must be repeated	(0% - 44%)
CR	Credit exemption	

## VI. EVALUATION PROCESS/GRADING SYSTEM (Continued):

The method of calculating your weighted average will be defined by your instructor. Since grades are based upon averages, it follows that good marks in some tests can compensate for a failing mark in another test.

### **Make-Up Test (if applicable)**

An "X" grade may be assigned at the end of the regular semester if you have met **ALL** of the following criteria:

- an overall average between 45% and 54% was achieved
- at least 50% of the tests were passed
- at least 80% of the scheduled classes were attended
- all of the topic tests were written

If you are assigned an "X" grade, you may convert it to a "C" grade by writing a make-up test on topics agreed to by the instructor. This test will be available at the time agreed to by your instructor.

At the end of the regular term, it is your responsibility to obtain your results from your instructor and, in the event of an "X" grade, to inquire when the make-up test will be available.

The score you receive on this make-up test will replace your original test score and be used to re-calculate your weighted average. If the re-calculated average is 55% or greater, a "C" grade will be assigned, if the re-calculated average is 54% or less, an "R" grade will be assigned.

### **"R" and "X" Grades at the end of the Semester**

If an "X" grade is not cleared by the specified date, it will become an "R" grade. Except for extenuating circumstances, an "X" grade in Math will not be carried into the next semester.

### **"R" Grades during the Semester**

A student with a failing grade and poor attendance (less than 80% attendance) may be given an "R" at any time during the semester.

## VII. SPECIAL NOTES:

Students with special needs (e.g. physical limitations, visual impairments, hearing impairments, learning disabilities), are encouraged to discuss required accommodations with the professor and/or contact the Special Needs Office.

### **Advanced Standing**

Students who have completed an equivalent post-secondary course must bring relevant documents to the Coordinator, Mathematics Department:

- a copy of course outline
- a copy of the transcript verifying successful completion of the equivalent course

Note: A copy of the transcript must be on file in the Registrar's Office.

## VIII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor or the Prior Learning Assessment Office (E2203).