**SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY**
**SAULT STE. MARIE, ONTARIO**

# COURSE OUTLINE

**Course Title: Calculus II**

**Code No.: MTH 577-4** **Semester: Four**

**Program: Electrical / Electronics / Mechanical**

**Author: The Mathematics Department**

**Date: June 2015** **Previous Outline Dated: June 2014**

**Approved: ___"Colin Kirkwood"_____ _____July/15_____**
**Dean** **Date**

**Total Credits: 4**
**Prerequisite(s): MTH 551**
**Hours/Week: 4**

## 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 mechanical, electrical/electronics technologies.

## II. LEARNING OUTCOMES:

The basic objectives are that the students develop an understanding of the methods studied, demonstrate 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.

**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.

## III. TOPICS TO BE COVERED: Approximate Time Frame

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| 1. Methods of Integration | 29 periods |
| 2. Expansion of Functions in Series | 15 periods |
| 3. Differential Equations and Laplace transforms | 20 periods |
| | Total: 64 hours |

| TOPIC NUMBER | TOPIC DESCRIPTION | REFERENCE CHAPTER ASSIGNMENTS |
|---|---|---|
| 1.0 | METHODS OF INTEGRATION | Chapter 28 |
| 1.1 | The general power formula | Exercise 28-1 |
| 1.2 | The basic logarithmic form | Ex. 28-2 |
| 1.3 | The exponential form | Ex. 28-3 |
| 1.4 | Basic trigonometric forms | Ex. 28-4 |
| 1.5 | Other trigonometric forms | Ex. 28-5 |
| 1.6 | Inverse trigonometric forms | Ex. 28-6 |
| 1.7 | Integration by parts | Ex. 28-7 |
| 1.8 | Integration by trigonometric substitution | Ex. 28-8 |
| 1.9 | Integration by partial fractions | Ex. 28-9, 28-10 |
| 1.10 | Integration by use of tables | Ex. 28-11 |
| 1.11 | Review exercise | |
| 2.0 | EXPANSION OF FUNCTIONS IN SERIES | Chapter 30 |
| 2.1 | Infinite series | Ex.30-1 |
| 2.2 | Maclaurin series | Ex. 30-2 |
| 2.3 | Certain operations with series | Ex. 30-3 |
| 2.4 | Computations by use of series expansions | Ex. 30-4 |
| 2.5 | Taylor's series | Ex. 30-5 |
| 2.6 | Fourier series | Ex. 30-6 |
| 2.7 | Review exercises | |
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| 3.0 | FIRST ORDER DIFFERENTIAL EQUATIONS | Chapter 31 |
| 3.1 | Solutions of differential equations. | Ex. 31-1 |
| 3.2 | Separation of variables | Ex. 31-2 |
| 3.3 | Integrable combinations | Ex. 31-3 |
| 3.4 | Linear first order differential equations | Ex. 31-4 |
| 3.5 | Elementary applications | Ex. 31-5 |
| 4.0 | HIGHER ORDER DIFFERENTIAL EQUATIONS | Chapter 31 |
| 4.1 | Homogeneous equations with constant coefficients | Ex. 31-6 |
| 4.2 | Auxiliary equations with repeated or complex roots | Ex. 31-7 |
| 4.3 | Solutions of non-homogeneous equations | Ex. 31-8 |

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| 4.4 | Applications of second-order differential equations | Ex. 31-9 |
| 4.5 | Laplace transforms | Ex. 31-10 |
| 4.6 | Solving differential equations by Laplace transformers. | Ex. 31-11 |
| 4.7 | Review exercise | |

## IV. REQUIRED RESOURCES / TEXTS / MATERIALS:

1. Text: Washington, "Basic Technical Mathematics With Calculus", 9th Edition, Metric Version. Benjamin/Cummings Pub. Co. 2009.

2. Calculator: (Recommended) SHARP Scientific Calculator EL-506L. The use of some kinds of calculators may be restricted during tests.

## V. EVALUATION PROCESS/GRADING SYSTEM:

**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.

The following semester grades will be assigned to students:

| **Grade** | **Definition** | *Grade Point Equivalent* |
|---|---|---|
| A+ | 90 – 100% | 4.00 |
| A | 80 – 89% | |
| B | 70 - 79% | 3.00 |
| C | 60 - 69% | 2.00 |
| D | 50 – 59% | 1.00 |
| F (Fail) | 49% and below | 0.00 |

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| CR (Credit) | Credit for diploma requirements has been awarded. |
| S | Satisfactory achievement in field /clinical placement or non-graded subject area. |
| U | Unsatisfactory achievement in field/clinical placement or non-graded subject area. |

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| X | A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course. |
| NR | Grade not reported to Registrar's office. |
| W | Student has withdrawn from the course without academic penalty. |

If a faculty member determines that a student is at risk of not being successful in their academic pursuits and has exhausted all strategies available to faculty, student contact information may be confidentially provided to Student Services in an effort to offer even more assistance with options for success. Any student wishing to restrict the sharing of such information should make their wishes known to the coordinator or faculty member.

**"F" and "X" Grades at the end of the Semester**

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

| **Course: MTH 577-4** | | |
|---|---|---|
| **Evaluation Device** | **Topics Covered** (reference topic numbers from the course outline) | **% weight of Final Average** |
| Test 1 | 1.1-1.6 | 25% |
| Test 2 | 1.7-1.11, 2 | 25% |
| Test 3 | 3 | 25% |
| Test 4 | 4 | 25% |

## VI. SPECIAL NOTES:

Attendance:

Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

Electronic Devices:

Personal use of electronic devices such as cell phones, iPods, MP3 players, tablets, laptop computers etc. during class is prohibited except as indicated in the addendum below.

## VII. COURSE OUTLINE ADDENDUM:

1. Course Outline Amendments:
   The faculty member reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

2. Retention of Course Outlines:
   It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

3. Prior Learning Assessment:
   Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question. Please refer to the Student Key Dates Calendar for the deadline date by which application must be made for advance standing.

   Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio. Student Services, located in E1101, can provide information regarding the Prior Learning Assessment and Recognition policy or it can be viewed on the student portal.

   Substitute course information is available in the Registrar's office.

4. Student Portal:
   The Sault College portal allows you to view all your student information in one place. mysaultcollege gives you personalized access to online resources seven days a week from your home or school computer. Single log-in access allows you to see your personal and financial information, timetable, grades, records of achievement, unofficial transcript, and outstanding obligations, in addition to announcements, news, academic calendar of events, class cancellations, your learning management system (LMS), and much more. Go to https://my.saultcollege.ca.

5. Communication:
The College considers Desire2Learn (D2L) as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of this Learning Management System (LMS) communication tool.

6. Accessibility Services:
If you are a student with a disability (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with the Accessibility Services office. Visit Room E1101, call Ext. 2703 or email studentsupport@saultcollege.ca so that support services can be arranged for you.

7. Audio and Video Recording Devices in the Classroom:
Students who wish to use electronic devices in the classroom will seek permission of the faculty member before proceeding to record instruction. Students with disabilities who require audio or visual recording devices in the classroom as an accommodation will receive approval from their counsellor once the Audio and Video Recording Devices in the Classroom Policy has been reviewed by the student. Recorded classroom instruction will be used only for individual academic use and will not be used for any other purpose. Recordings may only be used for individual study of materials presented during class and may not be published or distributed. Intentional misuse of audio and video recordings or intentional misrepresentation when requesting the use of a device for recording shall constitute a violation of this policy and laws protecting intellectual property.

8. Academic Dishonesty:
Students should refer to the definition of “academic dishonesty” in the Student Code of Conduct. Students who engage in academic dishonesty will be issued a sanction under the Student Code of Conduct which could lead to and include expulsion from the course/program. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, students must use a documentation format for referencing source material.

9. Tuition Default:
Students who have defaulted on the payment of tuition (tuition has not been paid in full, payments were not deferred or payment plan not honoured) as of the first week of November (fall semester courses), first week of March (winter semester courses) or first week of June (summer semester courses) will be removed from placement and clinical activities due to liability issues. This may result in loss of mandatory hours or incomplete course work. Sault College will not be responsible for incomplete hours or outcomes that are not achieved or any other academic requirement not met as of the result of tuition default. Students are encouraged to communicate with Financial Services with regard to the status of their tuition prior to this deadline to ensure that their financial status does not interfere with academic progress.