

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



COURSE OUTLINE

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|-------------------------|---------------------------------------|--------------------------------|----------------------|
| COURSE TITLE: | Calculus | | |
| CODE NO. : | MTH551 | SEMESTER: | 3 / 4 |
| PROGRAM: | Electrical/Electronics/Mechanical | | |
| AUTHOR: | Updated by the Mathematics Department | | |
| DATE: | Jan. 2016 | PREVIOUS OUTLINE DATED: | Jan. 2015 |
| APPROVED: | "Colin Kirkwood" | | Dec. 12/15 |
| | _____ Dean | | _____ DATE |
| TOTAL CREDITS: | 4 | | |
| PREREQUISITE(S): | MTH143 | | |
| HOURS/WEEK: | 4 | | |

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I. COURSE DESCRIPTION:

The basic concepts of calculus are introduced through an emphasis on applications and examples. Topics include limits, derivatives of algebraic, trigonometric and logarithmic functions, integration, and applications of differentiation and integration.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

Topic 1:

1. Evaluate limits of algebraic functions.
2. Approximate the slope of a tangent to a curve.
3. Find the derivative of an algebraic function using the delta method.
4. Find instantaneous rates of change of a function using derivatives.
5. Find the derivative of a polynomial using a rule.
6. Find derivatives of other algebraic functions (products and quotients) using rules for differentiation.
7. Find the derivative of a power of a function - Chain rule.
8. Find the derivative of an implicit function.
9. Find higher derivatives of algebraic functions

Topic 2:

1. Find slopes and equations of tangent and normal lines.
2. Compute velocities and accelerations for curvilinear motion.
3. Solve related rate problems.
4. Make graphs of non-linear functions using derivatives.
5. Make graphs of discontinuous functions using derivatives, asymptotes, intercepts.
6. Solve applied maximum-minimum problems.

Topic 3:

1. Use differentials to compute small change in a function.
2. Find an anti-derivative using derivative rules.
3. Use the basic rule for integration of algebraic functions.
4. Determine approximate areas under curves from graphs.
5. Determine exact areas under curves by integration - the fundamental theorem of integral calculus.
6. Evaluate other algebraic definite integrals.

Topic 4:

1. Solve problems involving distance-velocity-acceleration, current-voltage-charge using integration.
2. Find areas (between two curves) using horizontal and vertical elements and definite integrals.
3. Find the volume of a solid of revolution using the disk or shell method.

Topic 5:

1. Find derivatives of expressions containing sine or cosine functions.
2. Find derivatives of other trigonometric functions.
3. Find derivatives of inverse trigonometric functions
4. Solve worded problems which involve trigonometric functions.
5. Find derivatives of logarithmic functions - and constant base.
6. Find derivatives of exponential functions - any constant base.
7. Solve worded problems involving logarithmic of exponential functions.

III. TOPICS:

1. The Derivative
2. Applications of the Derivative
3. Integration
4. Applications of Integration
5. Differentiation of Transcendental Functions

IV. LEARNING ACTIVITIES

| TOPIC NUMBER | TOPIC DESCRIPTION | REFERENCE CHAPTER ASSIGNMENTS |
|---------------------|--|--------------------------------------|
| 1.0 | THE DERIVATIVE | Chapter 23 |
| 1.1 | Limits | Questions: 1-44 Page 634 |
| 1.2 | The slope of a tangent to a curve | Questions: 1-24 Page 639 |
| 1.3 | The derivative | Questions: 1-32 Page 643 |
| 1.4 | Derivatives of polynomials | Questions: 1-32 Page 652 |
| 1.5 | Derivatives of products and quotients of functions | Questions: 1-32 Page 656 |
| 1.6 | The derivative of a power of a function | Questions: 1-38 Page 662 |
| 1.7 | Differentiation of implicit functions | Questions: 1-32 Page 666 |
| 1.8 | Higher derivatives | Questions: 1-34 Page 669 |
| 2.0 | APPLICATIONS OF THE DERIVATIVE | Chapter 24 |
| 2.1 | Tangents and normals | Questions: 1-24 Page 677 |
| 2.2 | Curvilinear motion | Questions: 1-24 Page 685 |
| TOPIC NUMBER | TOPIC DESCRIPTION | REFERENCE CHAPTER ASSIGNMENTS |
| 2.3 | Related rates | Questions: 1-24 Page 688 |
| 2.4 | Using derivatives in curve sketching | Questions: 1-28 Page 695 |
| 2.5 | Applied maximum and minimum problems | Questions: 1-30 Page 704 |
| 2.6 | Differentials | Questions: 1-20 Page 704 |
| 3.0 | INTEGRATION | Chapter 25 |
| 3.1 | Anti-derivatives | Questions: 1-32 Page 717 |
| 3.2 | The indefinite integral | Questions: 1-44 Page 722 |
| 3.3 | The area under a curve | Questions: 1-20 Page 727 |
| 3.4 | The definite integral | Questions: 1-36 Page 730 |

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| 4.0 | APPLICATION OF INTEGRATION | Chapter 26 |
| 4.1 | Applications of the indefinite integral | Questions: 1-20 Page 745 |
| 4.2 | Areas by integration | Questions: 1-28 Page 751 |
| 4.3 | Volumes by integration | Questions: 1-32 Page 756 |
| 5.0 | DIFFERENTIATION OF TRANSCENDENTAL FUNCTIONS | Chapter 27 |
| 5.1 | Derivatives of sine and cosine functions | Questions: 1-50 Page 782 |
| 5.2 | Derivatives of other trigonometric functions | Questions: 1-48 Page 786 |
| 5.3 | Derivatives of inverse trigonometric functions | Questions: 1-48 Page 790 |
| 5.4 | Applications | Questions: 1-8, 11-23 Page 794 |
| 5.5 | Derivatives of logarithmic functions | Questions: 1-48 Page 799 |
| 5.6 | Derivatives of exponential functions | Questions: 1-52 Page 802 |
| 5.7 | Applications | Questions: 1-32 Page 806 |

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

1. Text: Washington, "Basic Technical Mathematics With Calculus", Ninth Edition, Metric Version. Addison Wesley 2010.
2. Scientific calculator

V. EVALUATION PROCESS/GRADING SYSTEM:

The following semester grades will be assigned to students:

| | Grade | Definition | <i>Grade Point Equivalent</i> |
|--|--------------|--|-------------------------------|
| | 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 |
| | 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. | |
| | X | A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course. | |

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|--|----|---|--|
| | NR | Grade not reported to Registrar's office. | |
| | W | Student has withdrawn from the course without academic penalty. | |
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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

VII. COURSE OUTLINE ADDENDUM:

1. Course Outline Amendments:

The professor 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 Academic Calendar of Events 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.

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

4. 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 your professor and/or the Accessibility Services office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

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. Academic Dishonesty:

Students should refer to the definition of “academic dishonesty” in *Student Code of Conduct*. Students who engage in academic dishonesty will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

7. 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.

8. 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>.

9. 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. With the exception of issues related to accommodations of disability, the decision to approve or refuse the request is the responsibility of the faculty member. Recorded classroom instruction will be used only for personal use and will not be used for any other purpose. Recorded classroom instruction will be destroyed at the end of the course. To ensure this, the student is required to return all copies of recorded material to the faculty member by the last day of class in the semester. Where the use of an electronic device has been approved, the student agrees that materials recorded are for his/her use only, are not for distribution, and are the sole property of the College.