

I. COURSE DESCRIPTION:

This course is a detailed study BJTs, JFETs, MOSFETs and OPAMPs as well as applications of these devices including transistor amplification, switching, timing circuits and OPAMP applications. This course will focus on operational analysis and troubleshooting of circuits employing these devices. Hands on skills will be reinforced in the laboratory component of this course, which includes device testing, circuit assembly, testing and troubleshooting.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Understand the construction and operation of a Bipolar Junction Transistor (BJT)

Potential Elements of the Performance:

- Describe the construction of a bipolar junction transistor (BJT) and the difference between the npn and pnp transistors.
- Describe the operation of a transistor in the active, cutoff and saturation regions and how to bias the transistor accordingly.
- Describe the transistor as a current-controlled device and state the relationship among the three terminal currents.
- Define beta and use it in transistor current calculations.
- Using a specification sheet, list the parameters and operating characteristics of different transistors.
- Describe how to test transistors in and out of circuit with an analog or digital meter.

2. Analyze, assemble, test and troubleshoot various BJT biasing configurations.

Potential Elements of the Performance:

- State the purpose of dc biasing for transistor circuits.
- Identify and analyze common transistor biasing circuits.
- Plot the dc load line for an amplifier and explain what the Q-point represents.
- Define and Calculate the Q-Point, Saturation and Cutoff.
- Describe, analyze and calculate the operation of a base-bias circuit, and explain why this bias is used when you require the transistor to act as a switch.
- Describe, analyze and calculate the operation of an emitter-feedback bias circuit.

- Describe, analyze and calculate the operation of a voltage-divider biasing circuit.
 - Assemble and test biasing circuits using proper test equipment.
 - Correctly use common test equipment in the analysis and troubleshooting of transistor circuits.
 - Analyze, test and troubleshoot, transistor switching circuits and amplifiers.
 - Identify and understand the operation of other transistor configurations including Darlington
3. Understand the operation of basic transistor amplifiers.

Potential Elements of the Performance:

- Identify and compare various Amplifier classes.
 - List the fundamental ac properties of amplifiers.
 - Derive the ac equivalent for a class A amplifier.
 - Explain and Calculate the effects of input and output impedance on voltage gain.
 - Perform a complete mathematical dc and ac analysis of a voltage divider bias class A amplifier.
 - Assemble and test a single stage amplifier for proper dc and ac voltages.
 - Troubleshoot a multi-stage amplifier in a safe and proper manner.
4. Understand the characteristics, operation, biasing, and testing of JFETs and MOSFETs.

Potential Elements of the Performance

- Identify the two types of JFETs and describe the construction and operation of each.
- Describe and analyse the different types of JFET biasing circuits.
- Compare FET characteristics, advantages and disadvantages with BJT's
- Identify the two types of MOSFETs and describe the construction and operation of each.
- Describe and analyse the different types of MOSFET biasing circuits
- Assemble, test and troubleshoot different JFET and MOSFET circuits.

5. Understand the operation, characteristics and applications of Operational Amplifiers (OPAMPS)

Potential Elements of the Performance:

- Describe the operational amplifier.
- Explain IC identification of an OPAMP.
- Explain the term differential amplifier.
- Describe the operation of a discrete differential amplifier.
- Using a specification sheet, list and understand the operating and electrical characteristics of OPAMPS.
- Describe, analyse and calculate the operation of common OPAMP circuits including Inverting, Non-Inverting, Follower, and Comparator.
- Assemble, test and troubleshoot common OPAMP circuits.

III. TOPICS:

1. Bipolar Junction Transistors, Circuits and Applications.
2. JFETs, MOSFETs and their applications.
3. Operational amplifiers and their applications

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

- Introductory Electronic Devices and Circuits (Conventional Flow Version) Seventh Edition – Robert T. Paynter – Prentice Hall.
- 1st Year Parts Package / DMM
- Assorted handouts as required
- Internet Resources

V. EVALUATION PROCESS/GRADING SYSTEM:

The final grade will be derived as follows:

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|--|-------------|
| • Theory - Tests (3) and Quizzes | = 45% |
| • Lab - Practical tests (1 or 2) and reports | = 50% |
| • 1 st Semester Review Test | <u>= 5%</u> |
| • TOTAL | =100% |

NOTE: You must obtain a minimum mark of 50% in both the Theory portion and the Lab portion of the course. Failing to do so, will result in an overall failing grade (F).

- **See Special Notes Section VI for further details affecting final grade.**

The following semester grades will be assigned to students in other than postsecondary courses:

Grade	<u>Definition</u>	<i>Grade Point Equivalent</i>
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	Below 50%	
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.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:

Additional Criteria:

- Attendance to lab activities is compulsory, unless discussed with the instructor in advance of the absence and the absence is for a medical or family emergency. A **deduction of 2% per Lab missed** will be imposed on the final mark. Your attendance to all classes and your final grade are directly related and as such, it is strongly recommended to attend all scheduled Theory Classes / Tutorials.
- Any student that is absent for any scheduled test (for a legitimate emergency) will be required to provide a doctors' note immediately upon returning. Failing to do so will result in a grade of 0% being assigned to the missed test. It is the students' responsibility to contact the college and/or Professor prior to the scheduled test. Test dates will be provided to the students, a minimum of 2 weeks in advance of the test date.
- Tests, quizzes and other activities will not be scheduled on an individual basis, unless it is for a medical or family emergency.
- Disruptions to theory classes, such as lateness, are not acceptable and will be dealt with on an individual basis. Students exhibiting chronic lateness or absenteeism will be required to meet with the Dean, and will be placed on academic probation.
- The use of Electronic Recording Devices is prohibited unless individual permission is obtained from the instructor. The use of Cell Phones during scheduled classes is prohibited. Turn off all Cell Phones before attending class.
- It is the responsibility of the student to check LMS daily for new postings, emails, assignments etc.

Additional Lab Criteria

- **ALL LAB'S MUST BE COMPLETED AND ALL LAB REPORTS MUST BE COMPLETED AND SUBMITTED WITHIN THE SPECIFIED DEADLINES. FAILING TO DO SO WILL RESULT IN A FINAL "F" GRADE BEING ASSIGNED REGARDLESS OF ALL OTHER MARKS RECEIVED DURING THE SEMESTER.**

- **Laboratory Reports** shall be subject to the handout and or criteria given at the start of the semester by the Professor. All Lab Reports are due **before** the start of the following weeks Scheduled Lab Class (or alternate indicated deadline) unless otherwise stipulated by the instructor. A **deduction of 20%** will be assessed for late submissions within the first 24 hour period following the deadline. A **deduction of 50%** will be assessed if submitted after this initial 24 hours, but before 48 hours.
- Reports submitted after 48 hours of the specified deadline will be considered as Not Completed (Weekends included in all deadline requirements).

Lab Reports are graded based on the following:

1. Ability to follow instructions (written and verbal)
2. Ability to follow specific technical procedures
3. Ability to use test equipment to obtain data
4. Accuracy and completeness of data
5. Ability to use required software
6. Ability to adhere to established deadlines
7. Ability to work within established time limitations
8. Ability to adapt to changes in requirements/processes.
9. Ability to draw conclusions based on objectives
10. Ability to produce a technical report as specified

It should be noted that these are essential skills as indicated in the Provincial Program Standards.

- **Incomplete submissions** will be returned to the student and will not be graded until such a time as they are completed. The maximum mark that can be obtained for incomplete labs re-submitted will be 50%. Incomplete reports must be re-submitted within 5 days from the date of being returned to the students (not the day the student picks up the graded report), otherwise it will be considered Not Completed and will result in a failing overall grade.
- **All Lab Reports must be submitted in a Duo-Tang cover (No Binders) unless otherwise noted. No loose papers will be accepted and as such will be graded 0%.**
- Practical Tests are individual evaluations of a students' ability to perform essential tasks in a safe and timely manner as outlined in provincial program standards.



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. Plagiarism:

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 <choose November, March, or June> 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. Electronic 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.