

I. COURSE DESCRIPTION:

This course is a study of the production, delivery and utilization of electrical power. Transmission and distribution equipment, system configurations, protection and control, and electrical load fundamentals will be discussed and analyzed

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. *Perform basic calculations for three phase alternating current systems.*

Potential Elements of the Performance:

- Convert actual power, voltage, current and impedance values to per unit values.
- Convert per unit electrical values to actual values.
- Reduce series/parallel networks to a single source/single impedance network.
- Solve a network using per unit and/or actual values for power, voltage and current levels throughout (balanced conditions).
- State the advantages and disadvantages of using the per unit method for calculating electrical parameters of power systems.
- Describe how real power flow is controlled in a power system and state the corresponding system indicators.
- Describe how reactive power flow is controlled in a power system and state the corresponding system indicators.

2. *Describe various options presently available for bulk generation of electrical power as well as those under consideration for future use.*

Potential Elements of the Performance:

- Describe the history of bulk electrical power generation in North America.
- State the three major categories of bulk electrical power generating stations in use today.
- State and briefly describe alternative sources of power generation that are presently being utilized.
- State and briefly describe potential future sources of electrical energy that are presently in the design or test stage.
- Identify all major mechanical and electrical components of a typical hydro generating station.
- Identify all major mechanical and electrical components of a

typical thermal generating station.

- State the common types of nuclear generating stations.
- Identify all major mechanical and electrical components of common nuclear generating stations..
- Discuss components common to thermal and nuclear generating stations
- Identify all major mechanical and electrical components of common wind power generating stations.
- Discuss energy conversion processes in hydro, thermal, nuclear and wind generating stations.

3. Describe alternating current (ac) and direct current (dc) transmission systems and their components.

Potential Elements of the Performance:

- Identify, state the purpose of, and describe each major component of an overhead transmission line.
- Describe corona and associated problems.
- Describe how lightning is created and its potential effects on a transmission line.
- Describe and draw equivalent circuits for short, medium length and long ac transmission lines.
- State how line impedance affects maximum power transfer of an ac transmission line.
- List and comment on the advantages and disadvantages of dc power transmission.
- Describe the various types of high voltage dc converter stations.

4. Describe transmission and distribution substations and their functions.

Potential Elements of the Performance:

- State the difference between transmission and distribution and describe how their definitions may vary to match given situations.
- List and describe the major components of a substation.
- List and describe the major categories of circuit breakers.
- Describe the operation and applications of various types of circuit breakers.
- Describe various 'name plate' parameters used to identify ratings and capacities of substation equipment.
- Describe various types of fuses and their operation.
- Describe the purpose of system grounding.

5. Describe the purpose of protective relays and how they interface with the power system.

Potential Elements of the Performance:

- List common electrical and mechanical faults that may occur in a power system.
- State the primary functions of protective equipment.
- Define protective relay.
- List various types of protective relays and describe their operation.
- Analyze time – current characteristic curves for various protective relays.
- Discuss the concepts of coordinated fault protection and zone coverage of power systems.
- Define symmetrical components using the alpha operator.

6. Describe the effects of harmonics on electrical power systems.

Potential Elements of the Performance:

- Define harmonics.
- List and describe terms used to quantify the effects of harmonics.
- List components of a power system susceptible to damage from harmonics and describe what damage may occur and how to prevent or minimize it.

III. TOPICS:

1. Power System Analysis
2. Power Generation
3. Power Transmission
4. Substations
5. Protective Relays
6. Harmonics

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Resource materials are available in the Sault College Library, from the instructor and on the Internet. No text purchase is required.

V. EVALUATION PROCESS/GRADING SYSTEM:

The final grade for the course will be determined as follows:

3 or 4 equally weighted tests: 100%

See special notes below.

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

VI. SPECIAL NOTES:

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.

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.

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.

Disability 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 Disability Services office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

Communication:

The College considers **WebCT/LMS** 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 the **Learning Management System** communication tool.

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>.

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.

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.

Other:

If a student misses a test he/she must have a valid reason (i.e. medical or family emergency – documentation may be required). In addition, the instructor **must** be notified **prior** to the test sitting. If this procedure is not followed the student will receive a mark of zero on the test with no make-up option.

Use of cell phones/PDAs for any form of communication (voice, text...) during class or lab time is strictly prohibited. Cell phones/PDAs must be silenced during regular class and lab times and must be turned off and kept out of sight during test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 being assigned.

Students may not wear earphones of any kind (i.e. for play back of recorded music/voice) during lab activities or test sittings. This does not include hearing aids required for hearing impaired.

Students are expected to maintain an active Sault College email account. They are required to check this email account daily. The instructor may announce details of lab and test requirements and scheduling through the Sault College email system (as well as sharing other important information).