SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

SAULT
COLLEGE

COURSE OUTLINE

COURSE TITLE:	Introduction to Solar PV / Thermal Energy Systems		
CODE NO. :	RET101	**SEMESTER:**	ONE
PROGRAM:	Renewable Energy and Green Construction Techniques		
AUTHOR:	Kieran O'Neill		
DATE:	September 2011	**PREVIOUS OUTLINE DATED:**	September 2010
APPROVED:	*"Corey Meunier"*		
	CHAIR		**DATE**
TOTAL CREDITS:	TWO		
PREREQUISITE(S):	N/A		
HOURS/WEEK: 2	TWO		

For additional information, please contact Corey Meunier, Chair
School of Technology & Skilled Trades
(705) 759-2554, Ext. 2610

I. COURSE DESCRIPTION:

Solar photovoltaics & site assessment is a comprehensive course including all the skills required to perform a solar PV assessment for a property. The course also includes an element of research and basic understanding into the issues of energy security and global warming in addition to solar PV system characteristics and performance.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Demonstrate proficiency in understanding of sun-earth dynamics in addition to measurements and seasonal variation of solar photovoltaics.

2. Demonstrate proficiency in understanding of the photovoltaic effect, solar cell design as well as performance losses. Additionally being able to discuss issues and topics such as energy security, global warming and the progression of global solar PV markets.

3. Demonstrate proficiency in understanding of solar photovoltaic definitions, performance indicators, module construction and any performance/operational constraints.

4. Demonstrate proficiency in understanding of solar photovoltaic components for grid and off-grid connected systems. Additionally being able to discuss and source current solar PV technology.

5. Demonstrate proficiency in understanding of solar PV site assessment methods (electronically and at site).

6. Demonstrate proficiency in understanding of site measurements and gathering of information during a solar PV site assessment.

III. TOPICS:

1. Introduction to Solar PV
2. Solar PV (sun-earth relationship)
3. Solar PV (concepts and issues)
4. Solar PV Systems
5. System sizing & Selection
6. Site Assessment

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

All resources provided.
Access to photocopier.

V. EVALUATION PROCESS/GRADING SYSTEM:

Attendance: 5%

Assignments 35%
- -Lab 1 (10%)
- -Lab 4 (10%)
- -Lab 6 (15%)

TEST 1 (30%) 30%

TEST 2 (30%) 30%

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

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:

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.

It is the departmental policy that once the classroom door has been closed, the learning process has begun. Late arrivers will not be granted admission to the room.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.

SAULT COLLEGE

Renewable energy & Green Construction Techniques

RET101 – Introduction to Solar PV

COURSE PLAN – Supporting texts or resources

Week/Hours	Topic/Chapter	Concepts Covered	In Class Lab (equipment needed)
Week 1 / 2 h	Introduction to solar PV (Intro Lecture)	• Current solar PV markets • Importance & global influence of solar energy • Solar photovoltaics in Ontario • Explanation of course content, experiment/lab projects and testing	Classroom (projector)
Week 2 / 2 h	Researching of global solar PV markets (Lab 1) (*Assignment 1)	Which solar PV markets are most prevalent / advanced and why is this so?	Computer Lab required
Week 3/ 2 h	Solar PV (Lecture 1)	• Light • Solar Radiation • Sun – Earth Geometry • Measurement of Solar Radiation • Regional and seasonal Variation of Solar Radiation	Classroom (projector)
Week 4/ 2 h	Solar PV (Lecture 2)	• History • Photovoltaic effect • Semi Conductors • I-V Curve • Performance Losses • Solar Cell Design • Types of PV Cells	Classroom (projector)
Week 5/ 2 h	Solar Energy video(s) (Lab 2)	• Global warming • Energy security • Issues surrounding solar energy and its development	Classroom (projector)

Week 6/ 2 h	Solar PV systems (Lecture 3)	• Introduction – Definitions – System performance indicators • PV Modules – Construction – Performance – Mismatch – Series/parallel – Bypass/blocking diodes	Classroom (projector)
Week 7/ 2 h	Group research reading and presentation (Lab 3)	Group reading and presentation of scientific paper relating to topics in lecture 1, 2, 3.	Classroom
Week 8/ 2 h	*Midterm Exam	Testing over lectures 1,2 and 3	Classroom
Week 9/ 2 h	Solar PV Systems (Lecture 4)	• Components (modules & inverters etc.) • System sizing	Classroom (projector)
Week 10/ 2 h	Internet Research of solar components and R&D (Lab 4) (*Assignment 2)	Students are required to research different available solar PV components online to familiarize themselves and classmates with today's technology as well as technology in R&D.	Computer Lab Required
Week 11/ 2 h	System Sizing & Selection (Lecture 5)	• Available area • Orientation of roof (south facing roof) • Setbacks from roof edges • Electricity requirements (more important when considering battery connected systems) • MicroFIT incentive • Battery storage	Classroom (projector)
Week 12/ 2 h	Site Assessment (Lecture 6) (Lecture 6)	• Collector area • Collector orientation • Inclination • Azimuth	
Week 13/ 2 h	Site assessment (in class practice) (Lab 5)	• Using Google earth • Google Sketch-up	Computer Lab required
Week 14/ 2 h	Practice site visit (take class on mock site visit) (Lab 6) *(Assignment 3)	A class trip to sites -real world solar assessment	No classroom required
Week 15/ 2 h	Course Review		Classroom (projector)
Week 16/ 2 h	*Final Exam	Covers some content from lectures 1-3 but focusing more on lectures 4-6	Classroom

SAULT COLLEGE

Renewable energy & Green Construction Techniques

RET101 – Introduction to Solar PV

DISTRIBUTION OF HOURS

Sequence/Type	Topics	# of Hours
Lecture	-Introduction to solar PV – current markets -Solar PV in Ontario -Explanation of course content, experiment/lab projects and testing	2
Lab 1	Individual researching of global solar PV markets (Which solar markets are most prevalent / advanced and why is this so?). Students will research solar PV around the world and present findings to classmates. (*Assignment 1 – students will write a 2000 word paper discussing one solar PV market around the world)	2
Lecture	Solar PV (Lecture 1) • Light • Solar Radiation • Sun – Earth Geometry • Measurement of Solar Radiation • Regional and seasonal Variation of Solar Radiation	2
Lecture	Solar PV (Lecture 2) • History • Photovoltaic effect • Semi Conductors • I-V Curve • Performance Losses • Solar Cell Design • Types of PV Cells	2
Lab 2	Solar Energy video (s) -global warming -energy security -issues surrounding solar energy and its development	2
Lecture	Solar PV systems (Lecture 3) • Introduction – Definitions – System performance indicators • PV Modules – Construction – Performance – Mismatch – Series/parallel – Bypass/blocking diodes	2

Lab 3	Students are grouped together and given a scientific paper relating to topics in lecture 1, 2, 3. The groups must read over the papers, interpret them and present the information to the class.	2
Test	Test over lectures 1,2 and 3	2
Lecture	• Solar PV Systems (Lecture 4) – Components (modules & inverters) – System sizing	2
Lab 4	Students are required to research different available solar PV components online to familiarize themselves and classmates with today's technology as well as technology in R&D. (*Assignment 4 – students are required to research one component relating to solar PV technology and write a 2000 word paper discussing its development, use and market)	2
Lecture	System Sizing & Selection (Lecture 5) • Available area • Orientation of roof (south facing roof) • Setbacks from roof edges • Electricity requirements (more important when considering battery connected systems) • MicroFIT incentive • Battery storage	2
Lecture	Site Assessment (Lecture 6) • Collector area • Collector orientation • Inclination • Azimuth	2
Lab 5	Site assessment (in class practice)	2
Lab 6	Practice site visit (take class on mock site visit) (*Assignment 3 – students will be required to perform a site assessment of a pre-selected site and will be graded to its accuracy and completeness)	2
Lecture	Course Review	2
Test	Final Exam	2
	Sub-Totals	32
	Lectures	16
	Labs/Experiments	12
	Testing	4
	TOTAL HOURS	**32**