SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	METALLURGY		
CODE NO. :	MET207	**SEMESTER:**	TWO
PROGRAM:	MECHANICAL PROGRAMS		
AUTHOR:	NEAL MOSS neal.moss@saultcollege.ca		
DATE:	January 2014	**PREVIOUS OUTLINE DATED:**	January 2013
APPROVED:	*"Corey Meunier"* **CHAIR**		**DATE**
TOTAL CREDITS:	2		
PREREQUISITE(S):	MCH 134		
HOURS/WEEK:	6		

I. COURSE DESCRIPTION:

The general objective of this course is to give students destined for the mechanical trades a basic understanding of metals and alloys they will be working with in heavy industry. A heavy emphasis is placed on the iron-carbon system and the physical metallurgy of steel including heat treating and welding. Some laboratory work on heat treating steel is included to witness the effect heat treating has on the microstructure and harness of carbon steel.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. INTRODUCTION TO METALLURGY

Potential Elements of the Performance:
Define:

i. Extractive Metallurgy
ii. Mechanical Metallurgy
iii. Physical Metallurgy

2. ATOMIC STRUCTURE OF METALS

Potential Elements of the Performance:
Explain the differences between the atomic order of:

i. Gases
ii. Liquids
iii. Solids

- Describe the atomic and crystalline structures of iron as a function of temperature.
- Describe how carbon can be in solid solution with iron.

3. IRON-CARBON EQUILIBRIUM DIAGRAM

Potential Elements of the Performance:

- Demonstrate an understanding of the iron carbon diagram.

4. TIME/TEMPERATURE/TRANSFORMATION

Potential Elements of the Performance:

- Describe what happens when iron-carbon alloys are cooled from the austenitic temperature region to room temperature in real time.
- Describe how differing cooling rates affect the structure of iron-carbon alloys.
- Describe what happens to the time/temperature diagram when

the carbon content is varied and when other alloying elements are added.
- Determine and demonstrate a plain carbon steel hardening process as assigned.
- Identify certain microstructures using a microscope.

5. STEEL ALLOYING AND PROCESSING (ROLLING/FORGING)

Potential Elements of the Performance:
To describe the effect that alloying and mechanical working has on:
i. The crystal structure of steel
ii. The mechanical properties of steel

6. HEAT TREATING

Potential Elements of the Performance:
To describe the processes and reasons for:
i. Normalizing
ii. Quenching and tempering
iii. Case hardening
iv. Annealing
v. Stress relieving

7. MECHANICAL PROPERTIES AND TESTING OF STEEL

Potential Elements of the Performance:
- Explain the procedures and interpretation of harness testing for Rockwell hardness
- Explain how elevated temperatures affect strength.
- Explain the procedure and interpretation of toughness testing and how low temperature affect toughness.
- Explain the phenomena of fatigue and creep.

8. WELDING

Potential Elements of the Performance:
To describe metallurgical effects of welding on the structure and properties of weldments.

9. INTRODUCTION TO STEEL SPECIFICATIONS

Potential Elements of the Performance:
- Explain what a standard is
- Explain what a specification is
- Explain how the numbering system in the AISI/SAE steel specification relates to chemical content of steel alloys.

III. TOPICS:

1. INTRODUCTION TO METALLURGY
2. ATOMIC STRUCTURE OF METALS
3. IRON-CARBON EQUILIBRIUM DIAGRAM
4. TIME/TEMPERATURE/TRANSFORMATION
5. STEEL ALLOYING AND PROCESSING (ROLLING/FORGING
6. HEAT TREATING
7. MECHANICAL PROPERTIES AND TESTING OF STEEL
8. WELDING
9. INTRODUCTION TO STEEL SPECIFICATIONS

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Booklet will be supplied by the instructor.
Textbook- Metallurgy Fundamentals, Daniel A. Brandt, J.C. Warner, Fifth Edition, Oxford University Press, ISBN; 9781605250793 1605250791

V. EVALUATION PROCESS/GRADING SYSTEM:

Attitude, Attendance & Participation –	*15%*
Assignments / Labs	*15%*
Tests & Quizzes	*70%*
	100 %

Attendance (**min. 80% req.)**	-*1*% (per Hour)
See Special Notes section	(late = 1 hour)
Safety Violations	-1% (per Occurrence, see notes below)

No Cell Phones are Permitted in The Classroom

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.

The Attitude Attendance and Participation mark is Based on a **Minimum** of 80 % attendance, if you miss 3 classes you receive a mark of 0 (zero) for this component.
It is the departmental policy that once the classroom door has enclosed, the learning process has begun. Late arrivers will not be granted admission to the room.

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.

VII. COURSE OUTLINE ADDENDUM:

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