SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

Sault College

COURSE OUTLINE

COURSE TITLE:	METALLURGY		
CODE NO. :	MET207	**SEMESTER:**	WINTER
PROGRAM:	MECHANICAL		
AUTHOR:	ROBERT ACKERT		
DATE:	DEC/07	**PREVIOUS OUTLINE DATED:**	JAN/07

APPROVED: _____ _____

CHAIR **DATE**

TOTAL CREDITS:	TWO
PREREQUISITE(S):	MCH 134
HOURS/WEEK:	TWO

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. Sections are included on mechanical testing and on aluminum, copper and other nonferrous alloys. 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:
i. Rockwell hardness
ii. Brinell Hardness
iii. Vickers Hardness
Explain the procedures and interpretation of tensile testing and to identify the various areas of the stress-strain diagram.
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
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.

10. NON FERROUS ALLOYS
Potential Elements of the Performance:
Describe the composition, physical properties and uses of the following metals in industry:
i. Aluminum and aluminum alloys
ii. Copper and copper alloys
iii. Bronze
iv. Brass
v. Lead, tin and lead-tin solders

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
10. NON FERROUS ALLOYS

IV. REQUIRED RESOURCES/TEXTS/MATERIALS: NONE – to be supplied by the instructor.

V. EVALUATION PROCESS/GRADING SYSTEM:

Class participation – 20%
Assignments – 30%
Test #1 - 25%
Test #2 – 25%

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:

Special Needs:
If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Special Needs office. Visit Room E1101 or call Extension 703 so that support services can be arranged for you.

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.

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.

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.

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.

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

<include any other special notes appropriate to your course>

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean’s secretary. Students will be required to provide a transcript and course outline related to the course in question.