

**SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY
SAULT STE MARIE, ON**



COURSE OUTLINE

Course Title: METALLURGY

Code No.: ASR118 **Semester:** 2

Program: AVIATION MACHINIST

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Date: NOVEMBER 1998 **Previous Outline Date:** N/A

Approved: K. DeRosario April 1/99
Dean Date

Total Credits: 3 **Prerequisite(s):**
Length of Course: 18 WKS **Total Credit Hours:**

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For additional information, please contact Kitty DeRosario, Dean, School of Trades
& Technology, (705) 759-2554, Ext. 642.

1. PHILOSOPHY / GOALS

A fundamental understanding of the microstructure of steels and aluminum will aid the student in grasping and appreciating the techniques used for machining and heat treating of these metals which are used extensively in the aviation industry.

2. STUDENT PERFORMANCE OBJECTIVES

Upon successful completion of this course , the student will:

- be able to describe the basic structures of steels and aluminums
- be able to discuss the manufacture of steels and aluminums
- have a basic understanding of heat treating processes
- have a basic understanding of the mechanical properties of steels and aluminums and how they are affected by heat treating

3. TOPICS TO BE COVERED

- Structure of metals (atomic structure, space lattice, crystallization and grain structure)
- Deformation and recrystallization (elastic and plastic deformation, grain growth, hot and cold working)
- Production of iron and steels
- Types of steels
- Principles of heat treatment (iron carbon diagram)
- Heat treatment (process and techniques)
- Production of aluminum
- Types of aluminums
- Principles of heat treatment (aluminum)
- Surface treatment of metals
- Destructive and non-destructive testing of metals

4. LEARNING ACTIVITIES

STRUCTURE OF METALS

- Discuss the atomic structure of metals
- Sketch B.C.C. and F.C.C. unit cell space lattice
- Discuss space lattice structure's of different metals and relate this to some mechanical and physical properties
- Discuss crystallization and recrystallization of grains through solidification and hot working
- Relate elastic and plastic deformation to stress-strain diagram

- Compare grain growth and shape with work hardening and then annealing

IRONS AND STEELS

- Discuss raw materials required for steelmaking
- Identify major components required in the steelmaking process
- Discuss flow chart of the steelmaking process
- Indicate the requirements for additives in the steelmaking process
- Relate steel structure (micro) and additives to mechanical properties
- Become familiar with carbon content and its affect with respect to mechanical properties, machining, and heat treating
- Discuss alloying elements with respect to mechanical properties, machining and heat treating
- Identify steels with the S.A.E. index
- List classification of tool steels
- Identify the need for tool steels
- Sketch and label iron-carbon diagram
- Using iron-carbon diagram relate temperature, carbon content and time to treat steels
- Discuss quenching and tempering
- Discuss annealing and aging
- Discuss surface treatments
- Draw sketches and use charts to coincide with differing heat treating techniques

ALUMINUM

- Identify and discuss the aluminum making process
- Differentiate cast and wrought aluminum
- List advantages and disadvantages to using aluminum and its alloys
- Compare alloy's of cast aluminum which can be heat treated to those that cannot
- Identify cast aluminum designation (Index)
- Compare wrought aluminum which can be heat treated to those that cannot
- Identify wrought aluminum designations (Index)
- Discuss various plating or cladding treatments for aluminum
- With charts and sketches discuss "solution" heat treatment
- With charts and sketches discuss "precipitation" heat treatment

DESTRUCTIVE AND NON-DESTRUCTIVE TESTING

- Describe and compare different types of hardness testers and their comparable scales
- Discuss torsion, fatigue, tensile and impact testing
- Name and describe some non-destructive testing methods

NOTE: Some testing will be demonstrated as time and equipment allows.

LAB COMPONENT

Two samples, one cold rolled steel and one of aluminum will be prepared by traditional lab procedures, for three analysis:

- 1) Macroscopic
- 2) Microscopic
- 3) Microscopic, subsequent to a heat treatment.

Information and material will be provided as lab progresses.

NOTE: LATE Lab assignments will NOT be accepted for grading.

EVALUATION

Homework	10%
Quizzes and Labs	30%
2 Term Tests	30%
1 Final Test	30%
	= 100%

GRADING

A+	(90-100%)
A	(80-89%)
B	(70-79%)
C	(60-69%)
R	(Below 60%) REPEAT

An "X" Grade can be given at the discretion of the instructor. The parameters to an "X" Grade will be attendance and minimum grade of 50%.

RESOURCES

TEXTS	"Properties and Uses of Ferrous and Non-Ferrous Metals"
	"Air Frame and Power Plant" A/C 65-9A
	"Machine Tool Practice" - 5th Edition

SPECIAL NOTES:

- **Special Needs**

If you are a student with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities), you are encouraged to discuss required accommodations with the instructor and/or contact the Special Needs Office, Room E1204, Ext. 493, 717, 491 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 post-secondary institutions.

- **Disclaimer for Meeting the Needs of the Learners**

- **Substitute Course Information is available at the Registrar's Office.**

- **Any Other Special Notes appropriate to your course.**

PRIOR LEARNING ASSESSMENT

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following: