

CAMBRIAN COLLEGE
of Applied Arts and Technology
Sault Ste. Marie

COURSE OUTLINE

METALLURGY

MET 201-4

Note: This course is offered as an option and may be taken instead of the "Pulp & Paper Technology" CHM 201-4 in the Industrial Chemistry Technician Program.

Metallurgy

MET 201-4

TEXT:

Elementary Metallurgy & Metallography by Schragar

REFERENCE:

Physical Metallurgy - Alner

Metallurgy - Johnson & Weeks

Handbook of Nonferrous Metallurgy - Liddel

Handbook of Nonferrous Metallurgy

(Recovery of Metals) - Liddell

Metallurgy

Option - (Industrial Chemistry)

MET 201-4

| Topic Number | Periods | Topic Information |
|--------------|---------|---|
| | | <u>Iron & Steel</u> |
| | | a) <u>Ores</u> |
| | | Definition |
| | | Types |
| | | Location of deposits |
| | | b) <u>Blast Furnace Process</u> |
| | | History |
| | | Redaction Process |
| | | Slag |
| | | Uses |
| | | c) <u>Cast Iron</u> |
| | | Definition |
| | | Types - Gray |
| | | White |
| | | Ductile ^ |
| | | Malleable |
| | | Wrought |
| | | Uses |
| | | d) <u>Steelmaking Processes</u> |
| | | Definition |
| | | History |
| | | Open Hearth Process |
| | | Basic Oxygen Process |
| | | Electric Arc Process |
| | | <u>Copper and Zinc</u> |
| | | a) <u>Ores</u> |
| | | Location of deposits |
| | | Extractive processes |
| | | b) <u>Properties 6c U^{se}s</u> |
| | | Strength |
| | | Ductility |
| | | Modulus of elasticity |
| | | Fatigue |
| | | Corrosion resistance |

Metallurgy

Option - Industrial Chemistry

MET 201-4

| <u>Topic Number</u> | <u>Periods</u> | <u>Topic Information</u> |
|---------------------|----------------|--|
| 3 | 3 | c) <u>Fabrication of Copper & its Alloys</u> Casting Hot & cold working Electroplating Joining |
| | | d) <u>Alloys</u> Types Properties Uses |
| | | <u>Aluminium</u> |
| | | a) <u>Ores</u> Location of deposits Extractive process |
| 4 | 3 | b) <u>Properties & Uses</u> Corrosion resistance Fatigue strength Creep strength Mechanical & physical Heat & electrical conductivity Weight |
| | | c) <u>Fabrication</u> Casting Mechanical working Joining |
| | | d) <u>Alloys</u> Types Properties Uses |
| | | <u>Magnesium</u> |
| 4 | 3 | a) <u>Ores</u> Location of deposits Extractive process |
| | | k) <u>Properties & Uses</u> Wear resistance |

Metallurgy

Option - Industrial Chemistry

MET 201-4

| <u>Topic Number</u> | <u>Periods</u> | <u>Topic Information</u> |
|---------------------|----------------|--|
| | | <u>Properties & Uses cont'd.</u> Fatigue strength Creep strength Corrosion resistance Weight |
| | | c) <u>Fabrication</u> Casting Mechanical working Joining |
| | | d) <u>Alloys</u> Types Properties Uses |
| | | <u>Nickel</u> |
| | | a) <u>Ores</u> Location of deposits Extractive processes |
| | | b) Properties & Uses |
| | | c) Effects of Alloying Elements |
| | | d) <u>Nickel Bases Alloys</u> Types - Monels Ni-Si-Cu base Inconel Ni-Fe base Ni-Mo-Fe base Properties Uses |
| | | <u>Lead</u> |
| | | a) <u>Ores</u> Location of deposits Extractive processes |
| | | b) Properties & Uses |
| | | c) Alloys |

Metallurgy
Option - Industrial Chemistry
MET 201-4

| <u>Topic Number</u> | <u>Periods</u> | <u>Topic Information</u> |
|---------------------|----------------|---|
| 7 | 1 | Tin a) <u>Ores</u> Location of deposits Extractive processes b) Properties & Uses c) Alloys |
| 8 | 30 | <u>Laboratory</u> a) <u>Hardness Tests</u> File Brinell Rockwell Scleroscope b) <u>Microscopy</u> Sampling Polishing Mounting Microetching Macroetching Metallurgical microscope c) <u>X-ray</u> Gamma ray Magnetic testing d) Heat Treatment Annealing Normalizing Induction hardening Case hardening Quench hardening Cyanide hardening |

The student should be able to:

1. Give a definition of Metallurgy and outline the subjects dealt with in Extractive, Physical, and Mechanical Metallurgy.
2. Give a definition of Mineral dressing.
3. Describe methods used to liberate minerals before separation, such as Crushing, Grinding, Autogenous milling.
4. To give a definition of the degree of liberation,
5. To discuss and calculate the recovery of metals and the problem of middlings.
6. Describe Methods of Magnetic Separation and name types of ores separated this way.
7. Describe methods of Heavy media separation and Gravity separation.
8. Describe the principle of Flotation and to perform a separation on a Laboratory Flotation cell.
9. Describe the process of Sintering.
10. Describe the process of Pelletizing.
11. Describe the process of coke making.
12. Name the raw materials used for iron making and explain their functions.
13. Describe the operation of a Blastfurnace.
14. Describe the chemical reactions taking place in the Blast furnace.
15. Give the material balance of a blast furnace.
16. Give the composition of Pig Iron.
17. Describe processes of steel making, the Puddling process, the Bessemer Process, the Open Hearth Process and the Basic Oxygen process.
18. Describe the relationship between Carbon Content, melting point of steel and components in steel. (Iron-Carbon Diagram)
19. To explain on the iron carbon diagram the meaning of the critical temperature lines, the eutectic and the eutectoid point.
20. Be able to identify under the microscope the components of steel, Ferrite, Pearlite, Martensite and explain their composition.
21. Be able to prepare steel specimens for microscopic examination by grinding, polishing and etching.
22. Be able to determine the hardness of steel by using the Rockwell hardness tester and the Shore scleroscope.
23. To explain other methods of hardness determinations, the Brinell and Vickers system.
24. To explain the following heat treatment processes: Annealing, Normalizing and Tempering.

To explain the following methods of Case hardening:
Cyaniding, Pack carburizing, Nitriding, Flame hardening.

To discuss the relationship between hardness of steel,
heat treating temperature and Carbon content from data obtained
from experiments.

To discuss the effect of Quenching media on the hardness of
steel from data obtained from experiments.