COURSE OUTLINE: MET207 - METALLURGY

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Approved: Corey Meunier, Dean, Technology, Trades, and Apprenticeship

Course Code: Title	MET207: METALLURGY
Program Number: Name	4039: MECH. ENG. TN-MANUFA 4040: MACHINE SHOP
Department:	MECHANICAL TECHNIQUES PS
Academic Year:	2024-2025
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 hardness of carbon steel.
Total Credits:	3
Hours/Week:	2
Total Hours:	28
Prerequisites:	There are no pre-requisites for this course.
Corequisites:	There are no co-requisites for this course.
Substitutes:	ASR118, MET212
Vocational Learning Outcomes (VLO's) addressed in this course: **Please refer to program web page for a complete listing of program outcomes where applicable.**	**4039 - MECH. ENG. TN-MANUFA** VLO 1 Complete all work in compliance with current legislation, standards, regulations and guidelines. VLO 2 Apply quality control and quality assurance procedures to meet organizational standards and requirements. VLO 3 Comply with current health and safety legislation, as well as organizational practices and procedures. VLO 6 Analyze and solve mechanical problems by applying mathematics and fundamentals of mechanical engineering. VLO 8 Contribute to the design and the analysis of mechanical components, processes and systems applying fundamentals of mechanical engineering. VLO 10 Verify the specifications of materials, processes and operations to support the design and production of mechanical components. VLO 12 Develop strategies for ongoing personal and professional development to enhance work performance. **4040 - MACHINE SHOP** VLO 1 Complete all work in compliance with current legislation, standards, regulations and guidelines.

	VLO 2	Contribute to the application of quality control and quality assurance procedures to meet organizational standards and requirements.
	VLO 3	Comply with current health and safety legislation, as well as organizational practices and procedures.
	VLO 9	Assist in manufacturing, assembling, maintaining and repairing mechanical components according to required specifications.
	VLO 10	Select, use and maintain machinery, tools and equipment for the installation, manufacturing and repair of basic mechanical components.
Essential Employability Skills (EES) addressed in this course:	EES 1	Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.
	EES 2	Respond to written, spoken, or visual messages in a manner that ensures effective communication.
	EES 5	Use a variety of thinking skills to anticipate and solve problems.
	EES 6	Locate, select, organize, and document information using appropriate technology and information systems.
	EES 7	Analyze, evaluate, and apply relevant information from a variety of sources.
	EES 8	Show respect for the diverse opinions, values, belief systems, and contributions of others.
	EES 9	Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.
	EES 10	Manage the use of time and other resources to complete projects.
	EES 11	Take responsibility for ones own actions, decisions, and consequences.
General Education Themes:	Science and Technology	
Course Evaluation:	Passing Grade: 50%, D A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.	
Other Course Evaluation & Assessment Requirements:	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.	
Books and Required	Handout provided	

Resources:	Safety Boots and Safety Glasses

Course Outcomes and Learning Objectives:

Course Outcome 1	**Learning Objectives for Course Outcome 1**
1. INTRODUCTION TO METALLURGY	1.1 Define: i. Extractive Metallurgy ii. Mechanical Metallurgy iii. Physical Metallurgy
Course Outcome 2	**Learning Objectives for Course Outcome 2**
2. ATOMIC STRUCTURE OF METALS	2.1 Explain the differences between the atomic order of: i. Gases ii. Liquids iii. Solids iv. Describe the atomic and crystalline structures of iron as a function of temperature. v. Describe how carbon can be in a solid solution with iron.
Course Outcome 3	**Learning Objectives for Course Outcome 3**
3. IRON-CARBON EQUILIBRIUM DIAGRAM	3.1 Demonstrate an understanding of the iron-carbon diagram.
Course Outcome 4	**Learning Objectives for Course Outcome 4**
4. CONTINUOUS COOLING TRANSFORMATION DIAGRAM	4.1 Describe what happens when iron-carbon alloys are cooled from the austenitic temperature region to room temperature in real time. 4.2 Describe how differing cooling rates affect the structure of iron-carbon alloys. 4.3 Describe what happens to the time/temperature diagram when the carbon content is varied and when other alloying elements are added. 4.4 Determine and demonstrate a plain carbon steel hardening process as assigned. 4.5 Identify certain microstructures using a microscope.
Course Outcome 5	**Learning Objectives for Course Outcome 5**
5. STEEL ALLOYING AND PROCESSING (ROLLING/FORGING)	5.1 To describe the effect that alloying and mechanical working has on: i. The crystal structure of steel ii. The mechanical properties of steel
Course Outcome 6	**Learning Objectives for Course Outcome 6**
6. HEAT TREATING	6.1 To describe the processes and reasons for: i. Normalizing ii. Quenching and tempering iii. Case hardening iv. Annealing v. Stress relieving
Course Outcome 7	**Learning Objectives for Course Outcome 7**
7. MECHANICAL PROPERTIES AND	7.1 Explain the procedures and interpretation of hardness testing for Rockwell scales.

	TESTING OF STEEL	7.2 Explain how elevated temperatures affect strength. 7.3 Explain the procedure and interpretation of toughness testing and how low temperature affect toughness. 7.4 Explain the phenomena of fatigue and creep.
	Course Outcome 8	**Learning Objectives for Course Outcome 8**
	8. WELDING	8.1 To describe metallurgical effects of welding on the structure and properties of weldments.
	Course Outcome 9	**Learning Objectives for Course Outcome 9**
	9. INTRODUCTION TO STEEL SPECIFICATIONS	9.1 Explain the difference between a standard and a specification. 9.2 Explain CSA designations for steel shapes, plates and bars for use in general construction and engineering purposes. 9.3 Explain how the numbering system in the AISI/SAE steel specification relates to chemical content of steel alloys.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Labs / Assignments	15%
Participation	15%
Tests and Quizzes	70%

Date: August 19, 2024

Addendum: Please refer to the course outline addendum on the Learning Management System for further information.