Course Outline for: VACT 2301 Thin Film Properties 1

A. Course Description

1. Number of credits: 1
2. Lecture hours per week: 3
3. Prerequisites: VACT 2300
4. Corequisites: none
5. MnTC Goals: none

Thin films have many desirable properties that can only be achieved through specialized material deposition processes. These properties can vary and are dependent on the many factors impacting the deposition process. In this course we explore mechanical, thermal and magnetic properties of materials. The physical vapor deposition process, a type of vacuum deposition method, is used to create different thin film samples which demonstrate these material properties. Characterization tools are used to measure the extent to which these material properties are present in the deposited material.

B. Date last reviewed/updated: March 2023

C. Outline of Major Content Areas

1. Mechanical Properties of Materials
2. Thermal Properties of Materials
3. Magnetic Properties of Materials
4. Thin Film Deposition and Characterization

D. Course Learning Outcomes

Upon successful completion of the course, the student will be able to:

1. Distinguish between elastic and plastic deformations and the critical points of each curve on a stress-strain diagram.
2. Describe the diffusion process and how it impacts grain growth and crystallization.
3. Explain why metals, ceramics and polymers have widely different mechanical properties.
4. Explain the phenomenon of thermal expansion and why it is important to thin film deposition.
5. Describe the types of thermal heat conduction in solids and the resulting impact in different materials.
6. Explain the two sources of magnetic moments in materials and how these affect a material's magnetic properties.
7. Differentiate between magnetic material types.

E. Methods for Assessing Student Learning

Methods for assessment may include, but are not limited to, the following:

1. Unit quizzes

2. A summative exam
3. Assessment of operation of thin film deposition and characterization equipment, in person or remote.
4. Homework assignments
5. Discussions
6. Collaborative projects
7. Other quizzes

F. Special Information

This course is the second of 3 modular 1-credit courses VACT 2300 (Material Science for Thin Film Deposition), VACT 2301, and VACT 2302 (Thin Film Properties II) that together are equivalent to VACT 2297 Thin Film Deposition.

Course instruction includes access to a thin film deposition equipment system to support material deposition activities and characterization instruments for measurement and data collection exercises.