

MENT105 General Safety and Materials

ECTS Value: 5 ECTS
Self-Study Hours: 60

Contact Hours: 25
Assessment Hours: 40

Overall Objectives and Outcomes

This unit covers the general requirements of the Occupational Health and Safety Authority and subsequent legislation and best safety practices adopted by various engineering technology firms, workshops and labs. Importance is also given to statistical records and reports as a tool to keep improving safety conditions. On the part of engineering technology, this unit covers the underpinning principles metallurgy, testing methods and use of materials.

By the end of this module, the learner will be able to:

Competences:

- a. Engage with research to evaluate common accidents or near missed safety incidents in vocational schools workshops and labs;
- b. Engage with research to evaluate best accident reporting systems for schools;
- c. Develop a critical understanding of basic atomic structure including the schematic representation of the Bohr atomic model and of the fundamental concepts of crystal structures including the Face Centred Cubic, Body centred Cubic and Hexagonal Close Packed Structures;
- d. Develop a critical understanding of the structure – process – performance relationship of how to change the property by manipulating the structure including of basic ceramic materials;
- e. Develop a critical understanding of organic chemistry, the chemistry and structure of hydrocarbon molecules and the polymerization process through which these molecules can form more complex molecules called polymers;
- f. Critically evaluate the basic chemistry and structure of natural Organic Materials with a focus on plant matter specifically word;
- g. Engage with literature to review different types of advanced materials such as semiconductors and smart materials which are gradually being introduced;
- h. Engage with literature to evaluate pedagogical developments on how to introduce young students to the underpinning principles of metallurgy;

Knowledge:

- a. Define the key features of the atomic structure including the schematic representation of the Bohr atomic model, the atomic number, isotopes, valence and mole;
- b. Explain the composition and properties of various ferrous metal alloys including steels and cast irons and how impurities can for solutions or alloys;

- c. Describe the meaning of secondary bonding;
- d. Describe the different defect types such as vacancies and explain how self-interstitials are formed;
- e. State the structure and properties of semiconductors materials and basic ceramic materials;
- f. Understand the polymerised chains structure of complex carbon polymers which are formed by monomer molecules' reaction together;
- g. Review the basic chemistry and physical structure and properties of Organic materials which are naturally occurring such as wood;
- h. Describe the polymetric structures, including molecular shape and structure of polymetric chains.

Skills:

- a. Assess different defect types such as vacancies (in materials);
- b. Demonstrate how different ferrous and non-ferrous metals such as copper, aluminium, magnesium can form alloys, different grades of steel and cast irons;
- c. Define the concept of a phase in the context of material science;
- d. Apply knowledge of organic chemistry to be able to select the best type of polymers to use for a particular application;
- e. Employ thermoplastics and thermosetting plastics as necessary;
- f. Relate particular characteristics (chemical and physical) to differences in carbon chain structures and composition;
- g. Apply practices to comply and enforce safety procedures in workshops and labs, follow risks assessments and engage in literature to stay updated on the subject content;

Assessment Methods

This module will be assessed through: Research Assignment.

Suggested Readings

Core Reading List:

1. Callister Jr, William D., (2013), Materials Science and Engineering. (9th Ed.) John Wiley and Sons.
2. Smallman R. E., Ngan A. H. W., (2014) Modern Physical Metallurgy, Eighth Edition. Butterworth-Heinemann.
3. Somiya Shigeyuki, (2013) Handbook of Advanced Ceramics: Materials, Applications, Processing, and Properties, Second Edition. Academic Press.

Supplementary Reading List:

1. Sidney Boone R., Christensen D. and Squire D. (1988). 'Wood Species Guide'. Furniture Design and Manufacturing. Retrieved from: <http://www.esf.edu/wus/documents/woodspeciesguide.pdf>
2. Canadian Council and Forintek Canada Corporation. (2016). *Structure and properties of wood*. Retrieved from http://www.tboake.com/2014/172-Structure_and_prop-2016.pdf