

**MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**MECHANICAL AND INDUSTRIAL ENGINEERING- ACADEMIC YEAR 2023/2024**

**ECE 204 MATERIAL SCIENCE FOR ELECTRICAL ENGINEERS**

**SEMESTER 2**

**Lecturer: Obondo B.O. 0789019623/0702688593**

**Course Objectives**

The course provides a thorough grounding in the scientific principles governing the physical, chemical, and mechanical properties of all solid materials, and the opportunity to specialize in the study of a particular class of material (metals, ceramic, glass, rubber and plastic polymer).

On successful completion of this module students will be able to:

- i. know the fundamental science and engineering principles relevant to materials;
- ii. Have knowledge of contemporary issues relevant to Materials Science and Engineering;
- iii. demonstrate an ability to analyze crystalline structures and calculate Miller indices, packing factor and density of selected unit cells and allotropy;
- iv. carry out an experiment to characterize materials their properties for an engineering application;
- v. Demonstrate an ability to analyze the mechanical behavior and physical properties of materials for the purposes of understanding their application in engineering.

Week 1-2: Introduction and Crystalline structure of materials, Miller indices

Weeks 3-4 Grain microstructure, lattice defects, dislocation and slip mechanisms.

Week 5 CAT 1

Weeks 5-6 Binary equilibrium diagrams; construction of equilibrium phase diagrams; types of equilibrium diagrams, the Lever rule

Weeks 7-8 Theory, reasons for alloying. Macro and Micro Examination of metallic surfaces.

Week 9 CAT 2

Week 9-10 Non-ferrous alloys; Aluminium, Copper, Titanium and their alloys

Week 11 . . Engineering polymers; overview of structure of polymers and polymerization processes. Classification of plastics, common plastics, processing, their uses and degradation process.

Week 12 Ceramics; nature and properties of ceramics and glasses.

Week 13 Composite materials; fiber and particle reinforcement of polymeric, metallic and ceramic matrices and finally Material Testing

**Mode of Delivery**

Lectures, Class discussions, group Presentations

**Course Assessment**

Final Examination	70%
Continuous Assessment Tests	20%
<u>Laboratory practical</u>	<u>10%</u>
Total	100%

**Mode of delivery**

Lectures, Class discussions, group Presentations, laboratory practicals and e-learning.

**Instructional Materials**

Handouts, textbooks, lecture notes, library and e-material.

**Course Evaluation**

Continuous Assessment	30%
End of Semester Examination	70%
Total	100%

**Recommended textbooks and references**

- i. William D. Callister Jr., Material Science and Engineering, 7Th edition John Wiley & Sons Inc., 2007.
- ii. Mikell P. Groover., (2007). Fundamentals of Modern Manufacturing; Materials, Processes and Systems, Third Edition
- iii. D.R. Askeland and P.P. Phule: The Science and Engineering of Materials, 4th Edition, Brooks/Cole. 2003.
- iv. J.M. Shackelford, Introduction to Material Science for Engineers, 5th Edition. Prentice-Hall, Inc. 2000.