MS1015 – Materials Science

Course Code	MS1015					
Course Title	Materials Science					
Pre-requisites	NIL					
Pre-requisite for	MS3015	Materials Aspects in Design				
No of AUs	3					
Contact Hours	LECTURES	26 hrs	TUTORIALS	13 hrs		

Course Aims

Materials Science is the study of the relationship of the properties of materials to the elemental composition at the atomic, microscopic and macroscopic levels. This course aims to develop your fundamental understanding of the effects of elemental composition, crystallographic structure and phase development on the physical and functional properties of materials. Understanding of these relationships helps you to achieve different functional properties in a given materials combination/system for a specific application that is necessary for a materials engineer.

Intended Learning Outcomes (LO)

By the end of this course, you (as a student) would be able to:

1. Predict the types of atomic and molecular bonds of materials based on the knowledge of the electronic configurations of the elements and the Periodic Table.
2. Construct basic crystallographic crystal structures (e.g., cubic), crystal planes and directions based on the Miller indices.
3. Explain the different types of imperfections in (metallic and ionic) solids and influence on materials properties.
4. Calculate the rate of atomic motion in a lattice and explain the effect of temperature on vacancy formation.
5. Explain the Hume-Rothery rules that govern the formation of solid solutions.
6. Determine mechanical properties of materials from stress-strain curves.
7. Interpret the equilibrium phase diagram and perform calculations to derive compositional and structural information.
8. Apply the band theory to explain the electrical properties of materials.
9. Perform calculations to determine the electrical conductivity of metals and semiconductors.
10. Interpret BH curves of magnetic materials.
11. Estimate the thermal properties of materials on basis on their density, bond strength and types of bond.
12. Explain optical properties of solid materials on basis of materials classes, crystal structures and bonds

Course Content

Electronic configuration of atomic structure and bond types; Crystal structure; Crystal defects; Diffusion in solid systems, Equilibrium phase diagrams; Mechanical, Electrical, Magnetic, Thermal and Optical properties of materials.

Reading and References

Suggested Reading:

Materials Science and Engineering, 9th Edition, SI Version, Willian D. Callister, David G. Rethwisch, 2014, John Wiley & Sons Inc.

Additional reading:
Introduction to Materials Science for Engineers, James F. Shackleford, 8th Edition, Global Edition, Pearson.

Course Policies and Student Responsibilities

(1) Homework Assignments
Submission of homework assignments are only accepted during lecture hours.
(2) CA
Absentees must be supported by a medical certificate or other valid official documents.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.