

Course Description:

Introducing fundamentals of magnetic materials for the next-generation magnetic, nanomagnetic, and spintronics-related technologies. Includes basics of magnetism paramagnetic and diamagnetic materials, soft and hard magnetic materials, and magnetic system design foundations.

Learning Objectives:

1. To acquire knowledge on the basics of magnetic phenomena on materials
2. To impart knowledge in the field of material science and their applications in electrical engineering

Pedagogy: Normal Mode

Syllabus:**Module 1**

Magnetic Materials: Magnetism: Concept of magnetism, Different types of magnetic materials: Origin of permanent magnetic dipoles- Classification of magnetic materials dia-, para-, ferro-, antiferro- and ferri-magnetic materials -Curie-Weiss law- Properties and application of iron, alloys of iron- Hard and soft magnetic materials- Hysteresis; Applications. - The Influence of Temperature on Magnetic Behaviour.

Module 2

Core-Loss Calculation for Magnetic Components Employed in Power Electronic Systems: Magnetic materials used in converters - Specific Core loss – Steinmetz’s equation - Magnetic Materials used for high frequency applications – commercially available magnetic materials - Iron Alloy Cores - Amorphous Alloy Cores - Nickel–Iron and Cobalt–Iron Cores – Ferrite Cores - Powder Cores - Nano-crystalline Cores – Superconductors - Hysteresis Core Loss - Eddy- Current Core Loss - Total Core Loss,– properties – specific core loss with different core materials and Geometries –Loss Measurement Method - case study using proper simulation platforms.

References:

1. B. D. Cullity and C. D. Graham, Introduction to magnetic materials. John Wiley & Sons, Inc, 2011
2. Materials Science and Engineering, V. Raghavan, Prentice Hall of India Private Limited, New Delhi (2004).
3. Modern magnetic materials Principles and Applications , ROBERT C. O'HANDLEY Massachusetts Institute of Technology

Course Outcome:

CO1: Classify magnetic materials and describe different laws related to them

CO2: Acquire knowledge about specific core loss in different core materials

Evaluation Pattern:

Midterm Exam
Assignments
Design Exercise
End Exam

Employability:

Designed for analytical research