13-ES103 ENGINEERING MATERIALS SCIENCE

SYLLABUS

Crystal Structure And Crystallography: Crystal lattice – primitive and unit cell – crystal systems – Bravais lattice – Miller indices – Structure of Crystal – Simple Cubic, Body Centered Cubic, Face centered Cubic and Hexagonal Close Packed structure. Sodium chloride structure, X ray Spectrum – Moseley's law – diffraction of X-rays by crystals – Bragg's law in one dimension – Experimental methods in X-ray diffraction – Laue's method, rotating crystal method – powder photograph method – point defects - line, surface and volume defects – effects of crystal imperfections, Applications.

Magnetic Properties Of Materials: Basic concepts – magnetic moment, susceptibility, permeability; Types of materials – Diamagnetic, paramagnetic, ferromagnetic, anti ferromagnetic and ferrimagnetic materials, Weiss theory of ferromagnetism, domain theory of ferro magnetism, Ferrites, Hysteresis effect; Soft and hard magnetic materials; Applications- Fabrication of transformers, motors, magnetic storage devices- magnetic memories, magnetic tapes, magnetic recorder, relays and sensors

Electrical Properties Of Materials: Introduction to electrical materials – Band theory of solids-conducting materials -Ohm's law, electrical conductivity, electrical resistivity –, semiconducting materials, types – properties and effects of impurities and temperature. Insulating materials –. Requirements of good insulating materials: Some insulating materials – glass, mica, ceramics, asbestos, resins, rubber, transformer oil. Introduction to Dielectric materials – Polar and non-polar dielectrics, Dielectric constant, Dielectric Polarization – electronic, ionic, orientation or dipolar and space charge polarizations(qualitative treatment), frequency and temperature dependence of polarization, ferro electricity- spontaneous polarization and structure of barium titanate .Piezo electricity & Piezo electric materials- applications.

Mechanical And Thermal Properties Of Metals: Definitions – elasticity, plasticity, Stress, strain, strength, hardness, brittleness, ductility, creep, fatigue, fracture, and toughness. Relationship between stress and strain; Hardness – Hardness tests, Heat treatment processes (Tempering, Quenching Nitriding, Hardening), specific heat and thermal conductivity.

Micro And Nano Materials: Agile materials for microwave components, Terahertz meta materials and its applications (Radar Sensors, and Future wireless communications), Basic concepts of Nano Science and technology, Size effects of materials, Nano materials classification and Properties, Nano material preparation by sol-gel method and Chemical Vapor Deposition method..Introduction to Carbon nano tubes (CNT's), Synthesis of CNT's by bottom up Approach, Properties of Carbon nano tubes and their applications in science and techno technology.

BOOKS

1.Materials Science and Engineering by Callister, WILEY Publishers(2008)
2.Introduction to Solid State Physics – C.Kittel, John Wiley(2004)
3.Materials Science for Engineering Students-FISCHER,,Elsevier Publishing.USA

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REFERENCE BOOKS:

1. Material Science by V.Raghavan (TMH)
2.Solid State Physics, 6th Edition, S.O.Pillai, New age International Publishers
3.Material Science – M. Arumugam, Anuradha Agencies, (2004)
4.Solid State Physics – A.J.Deckker(2004)