

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IITDM) KANCHEEPURAM

INTRODUCTION OF NEW COURSE

Course Title	Material Science for Electrical and Electronics Engineers	Course No	ELE5XXX			
Specialization	Electronics Engg	Structure (LTPC)	3	0	0	3
To be offered for	UG/PG	Status	Core <input type="checkbox"/>	Elective <input checked="" type="checkbox"/>		
Faculty Proposing the course	Dr. B Raja	Type	New <input checked="" type="checkbox"/>	Modification <input type="checkbox"/>		
Date of DAC	12-11-2018	Members Present in DAC	All Faculty Members of the Dept. External Member: Prof. S. Karmalkar, EE Dept, IIT-M			
Pre-requisite	Science and Engineering of Materials/ Basic Material Science and CoT	Submitted for approval	39 th Senate			
Learning Objectives	The course aims in highlighting the essential materials used in electrical and electronic components and their important properties. The application like electrical machines, dielectrics substances, insulation, semiconductors and PCBs will be dealt in the course.					
Learning Outcomes	The student will be able to enhance their knowledge on material and its properties that are used in electrical machines, dielectric, insulation, semiconductors and PCBs.					
Contents of the course (With approximate break-up of hours)	<p>Magnetic Materials Used in Electrical Machines, types, magnetic properties, iron losses, flux-density distribution, magnetization schemes, hot spots, magnetization curve, Loss-to-squared flux density factor, Influence of Temperature, Hysteresis Loop, Curie Temperature, Material Comparison and Deterioration Influences, SiFe, NiFe, CoFe lamination steels, amorphous magnetic materials, Treatment of Laminated Material (8)</p> <p>Dielectric properties of insulator in static fields - Dielectric properties - Polarization and Mechanism - Solid Dielectrics, Ionic Dielectrics, Polar Solids - Ferro electric materials and Classification - Piezoelectric, Pyroelectric and Electrostritive materials, Electromechanical coupling coefficient. Dielectric materials in alternating field, Frequency Dependence; Non-polar solids, Dipolar relaxation; Debye equation, Cole-Cole Equation; Dielectric loss, Equivalent Circuit (8)</p> <p>Insulating materials - Properties, Resistance, Breakdowns - Intrinsic, Thermal, Discharge-Dependent, Physical Defect-Dependent, Breakdown Voltage, Thermal oxidation; Paper, Press board, Fibrous materials; Impregnating, Coating, Filling and Bonding material, Liquid insulating material, varnishes, Dielectric gases, Composite dielectric material, High voltage insulation materials, Insulation Class, Standards (6)</p> <p>Semiconductors - types; chemical bonding and development of band gap, Intrinsic semiconductors, and Extrinsic Semiconductors - Doping and Doping Process, Fermi energy position, temperature dependence, carrier concentration, mobility and hall effect, Impact ionization, Hydrostatic pressure dependence, Effective mass, Recombination parameters; Fabrication materials for Semiconductor device - Passive materials, Fabrication methods; Advanced semiconducting materials - GaN, AlN, InN, BN, SiC, SiGe; Thermo-electric material - Seebeck series and coefficient, Photovoltaic semiconductors - Absorption coefficient, Phosphorous and Boron Doped Silicon, GaAs, InP, Ge (14);</p> <p>PCB types and materials - dielectric substrate, mechanical strength, thermal properties of PCBs - glass transition temperature and thermal expansion of PCBs, flexible PCBs, Application of Silicone and Kapton. (6)</p>					
Text Books	<ol style="list-style-type: none"> 1. I.Jones, Materials Science for Electrical and Electronic Engineers, Oxford Univ Press, 1st Ed, 2007 2. D. P. Kothari, M. Jain, S. Jagwani, Electrical and Electronics Materials, Alpha Science International, 1st Edition, 2015 					
Reference Books	<ol style="list-style-type: none"> 1. D. K. Schroder, Semiconductor Material and Device Characterization, Wiley-IEEE Press, 3rd Ed, 2006 2. E. A. Irene, Electronic Materials Science, Wiley-Blackwell, 1st Edition, 2005 3. S.Kasap, Principles of Electronic Materials and Devices, McGraw-Hill Ed, 3 edition, 2005 4. W. D. Callister, Materials Science and Engineering - An Introduction, Wiley, 7th Edition, 2008 					