Course No.	Course Name	L-T-P -Credits	Year of Introduction
EE206	MATERIAL SCIENCE	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

To impart knowledge in the field of material science and their applications in electrical engineering

Syllabus:

Conducting materials- properties-applications- Semi conductor materials- properties-applications-Magnetic materials-classification-alloys of iron-ferrites-Dielectric materials-polarization-solid, liquid and gaseous insulators-Dielectric breakdown-superconductors-solar energy materials-Spectroscopy-micropscopy-magnetic resonance-nanomaterials

Expected Outcome:

After the completion of the course student will be able to:

1. Describe the characteristics of conducting and semiconducting materials
2. Classify magnetic materials and describe different laws related to them
3. Classify and describe different insulators and to explain the behaviour of dielectrics in static and alternating fields
4. Describe the mechanisms of breakdown in solids, liquids and gases
5. Classify and describe Solar energy materials and superconducting materials
6. Gain knowledge in the modern techniques for material studies

Text Book:

1. Dekker A.J : Electrical Engineering Materials, Prentice Hall of India
2. G K Mithal : Electrical Engg Material Science. Khanna Publishers.

References:

1. Tareev, Electrical Engineerin Materials, Mir Publications
2. Meinal A.B and Meinal M. P., Applied Solar Energy – An Introduction, Addisos Wesley
3. Nasser E., *Fundamentals of Gaseous Ionization and Plasma Electronics*, Wiley Series in Plasma Physics, 1971
4. Naidu M. S. and V. Kamaraju, *High Voltage Engineering*, Tata McGraw Hill, 2004
5. Indulkar O.S &Thiruvegadam S., An Introduction to electrical Engineering Materials, S. Chand
6. Agnihotri O. P and Gupta B. K, Solar selective Surface, John wiley
7. Seth. S.P and Gupta P. V, A Course in Electrical Engineering Materials, Dhanpathrai

Course Plan

Module	Contents	Hours	Sem.ExamMarks
I	Conducting Materials: Conductivity- dependence on temperature and composition – Materials for electrical applications such as resistance, machines, solders etc. Semiconductor Materials: Concept, materials and properties- – Basic ideas of Compound semiconductors, amorphous and organic semiconductors- applications. Dielectrics: Introduction to Dielectric polarization and classification –Clausius Mosotti relation- Behavior of dielectric in static and alternating fields	8	15%
II	Insulating materials and classification- properties- Common insulating materials used in electrical apparatus-Inorganic,	6	15%

	organic, liquid and gaseous insulators- capacitor materials- Electro-negative gases- properties and application of SF6 gas and its mixtures with nitrogen Ferro electricity.		
FIRST INTERNAL EXAMINATION			
III	Dielectric Breakdown: Mechanism of breakdown in gases, liquids and solids –basic theories including Townsend's criterion, Streamer mechanism, suspended particle theory, intrinsic breakdown, electro-mechanical breakdown- Factors influencing Ageing of insulators- Application of vacuum insulation- Breakdown in high vacuum-Basics of treatment and testing of transformer oil .	7	15%
IV	Magnetic Materials: Origin of permanent magnetic dipoles- Classification of magnetic materials -Curie-Weiss law- Properties and application of iron, alloys of iron- Hard and soft magnetic materials– Ferrites- Magnetic materials used in electrical machines, instruments and relays-	7	15%
SECOND INTERNAL EXAMINATION			
V	Superconductor Materials:-Basic Concept- types- characteristics-applications Solar Energy Materials: Photo thermal conversion- Solar selective coatings for enhanced solar thermal energy collection –Photovoltaic conversion – Solar cells -Silicon, Cadmium sulphide and Gallium arsenic – Organic solar cells.	7	20%
VI	Modern Techniques for materials studies: Optical microscopy – Electron microscopy – Photo electron spectroscopy – Atomic absorption spectroscopy – Introduction to Biomaterials and Nanomaterials	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN (End semester exam)

Part A: 8 questions.
One question from each module of Module I - IV; and two each from Module V & VI. Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering modules I&II.
Student has to answer any 2 questions: (2 x 10) =20

Part C: 3 questions uniformly covering modules III&IV.
Student has to answer any 2 questions: (2 x 10) =20

Part D: 3 questions uniformly covering modules V&VI.
Student has to answer any 2 questions: (2 x 10) =20

Note: Each question can have maximum of 4 sub questions, if needed.