NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE TEMPLATE			
Course Title	Electrical, electronic and magnetic materials		
Course Code	MTPC12	No. of Credits	3
Department	MME	Faculty	Mr.R.Nivas
Pre-requisites Course Code	MTIR15 – Introduction to MME		
Course Coordinator(s) (if applicable)	Not applicable		
Tutor(s) E-mail	nivas@nitt.edu	Contact No.	8903486557
Course Type	core course		

COURSE OVERVIEW

This course deals with the effect of sub atomic factors that influence electrical, magnetic and optical properties of different engineering materials. Theories explaining their behaviour will be discussed.

COURSE OBJECTIVES

To understand the basic principles and physical origins of electronic, magnetic and optical properties of materials and to study the various materials which exhibit these functional properties.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
1. To understand the band gap theory for conducting, semiconducting and insulating materials. To understand various electrical phenomenon such as ferro electricity, piezo electricity and pyro electricity along with dielectric behaviour of materials	[1]
2. To study various kinds of magnetism principles, various types of materials exhibiting magnetism and their day to day applications in industry with recent advancements.	[1,2,5]
3. To study the theory of superconductivity phenomenon and superconducting materials and their applications along with recent advancements [5, 8].	[5,8]
4. Understand the fundamentals of semiconducting materials and operational principles of solid state devices made of these semiconducting materials. To learn various methods of producing	[2,11]

semiconductors and their processing methods used in the semiconducting materials industry. 5. To learn about photoconduction phenomenon, optical materials and various optical devices and their performances.	[1]

COURSE TEACHING AND LEARNING ACTIVITIES

Sl.No	Week	Topic	Mode of Delivery
1	1st & 2nd Week	Free electron theory - Band theory - discussion on specific materials used as conductors - Dielectric phenomena - concept of polarization- frequency and temperature dependence - dielectric loss - dielectric breakdown	Chalk and Talk
2	3rd & 4th Week	ferro electricity - piezo electricity and pyro electricity – $BaTiO_3$ – structure and properties. Origin of Magnetism - Introduction to dia, para, ferri and ferro magnetism – Curie temperature	Chalk and Talk
3	5th Week	Magnetic anisotropy - hard and soft magnetic materials- iron based alloys - ferrites and garnets – rare earth alloys - fine particle magnets.	Chalk and Talk
4	6th & 7th Week	Concept of superconductivity – BCS theory of super conductivity – Types of super conductors –YBCO- structure and properties – specific super conducting materials – Fabrication and engineering applications.	Chalk and Talk
5	8th & 9th Week	Semiconducting materials and types; simple, compound and oxide semiconductors – semiconducting materials in devices –	Chalk and Talk

6	10th week	Production of silicon starting materials – methods for crystal growth for bulk single crystals- zone melting – Czochralski method – Epitaxial films by VPE, MBE and MOCVD techniques – Lithography	Chalk and Talk
7	11th & 12th Week	Principles of photoconductivity, luminescence- - photo detectors – Optical disc and optoelectronic materials –LCD, LED and diode laser materials - electro optic modulators - Kerr and Pockel's effect – $LiNbO_3$.	Chalk and Talk
8	13th Week	Revision classes	Chalk and Talk
9	14th Week	Final Assessment	

COURSE ASSESSMENT METHODS

Sl.No	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment 1 (Written test)	5th Week	1 hour	15 %
2	Assessment 2 (Written test)	10th Week	1 hour	15 %
3	Assignments (2)			10 %
4	Seminar	A 10 minute oral presentation		10 %
5	Final Assessment (Written test)	14th Week	3 hours	50 %

ESSENTIAL READINGS : Textbooks, reference books etc.,

1. Kittel C., 'Introduction to Solid State Physics', 7th Edition, Wiley Eastern, New International Publishers, 2004
2. Dekker A. J., 'Electrical Engineering materials, Prentic Hall, 1995
3. Ed. Kasap and Capper, handbook of electronic and photonic materials, 2006, NY.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

The exit survey will be assessed based on the questionnaire prepared by the Institute/class teacher and the expected attainment to be greater 75%. The feedback collected from students by the Institute is to be informed to the teacher to improve the course in future semesters.

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. The students are expected to attend all the classes except for medical reasons. Minimum attendance of 75% (including the concession for on-duty and medical reasons) is required for writing the semester examination.
2. The relative grading policy will be followed and the passing minimum marks will be fixed based on Institute guidelines.

ADDITIONAL COURSE INFORMATION

FOR SENATE'S CONSIDERATION

Course faulty (R.Nivas)	CC-Chairperson (Dr.S.Jerome)	HOD (Dr.S.P.Kumaresh Babu)