DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	Electrical, Electronic and Magnetic Materials		
Course Code	MTPC12	No. of Credits	03
Course Code of Pre-requisite subject(s)	MTIR15		
Session	JAN 2018	Section (if applicable)	NA
Name of Faculty	Mr. TEJAS R	Department	MME
Email	tejas@nitt.edu	Telephone No.	8608361648
Name of Course Coordinator(s)	-		
E-mail	-	Telephone No.	-
Course Type	■ Core course	☐ Elective course	

Syllabus (approved in BoS)

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 - 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 – Magnetic anisotropy - hard and soft magnetic materials- iron based alloys - ferrites and garnets – rare earth alloys - fine particle magnets.

Concept of superconductivity – BCS theory of super conductivity – Types of super conductors – YBCO-structure and properties – specific super conducting materials – Fabrication and e applications.

Semiconducting materials and types; simple, compound and oxide semiconductors – semiconducting materials in devices – 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

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 – $LiNbO_3$

COURSE OBJECTIVES

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

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
At the end of the course the student will be able to	
1. To understand the band gap theory for conducting, semiconducting and insulating materials.	1, 4, 5
2. To understand various electrical phenomenon such as ferro electricity, piezo electricity and pyro electricity along with dielectric behaviour of materials	1

3. 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
4. To study the theory of superconductivity phenomenon and superconducting materials and their applications along with recent advancements. Understand the fundamentals of semiconducting materials and operational principles of solid state devices made of these semiconducting materials. To learn various methods of producing semiconductors and their processing methods used in the semiconducting materials industry	5, 8 2, 11
5. To learn about photoconduction phenomenon, optical materials and various optical devices and their performances	1

COURSE PLAN – PART II

COURSE OVERVIEW

This course will introduce the students to various materials and their properties which lend them functional characteristics.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week #1 - #3	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 - ferro electricity - piezo electricity and pyro electricity – BaTiO3 – structure and properties.	Chalk-Talk and PPT
2	Week #4 - #6	Origin of Magnetism - Introduction to dia, para, ferri and ferro magnetism – Curie temperature – Magnetic anisotropy - hard and soft magnetic materials- iron based alloys - ferrites and garnets – rare earth alloys - fine particle magnets.	Chalk-Talk and PPT
3	Week #7 - #8	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-Talk and PPT
4	Week #9 - #11	Semiconducting materials and types; simple, compound and oxide semiconductors – semiconducting materials in devices – 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-Talk and PPT
5	Week #12 - #13	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 – LiNbO3	Chalk-Talk and PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I (Written Test)	7th Week	45 mins	20%
2	Assessment II (Written Test)	12th Week	45 mins	20%

CPA	Compensation Assessment	14th Week	45 mins	20%
3	Assignment	7th to 10th Week	2 weeks	10%
4	Final Assessment	15th Week	3 Hrs	50%

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback (anonymous) will be collected towards the end of semester through the class representative.

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/phone etc)

Course related details and exact date-time for the assessments will be intimated to the students at appropriate time via webmail through class representatives.

Students can send any queries directly to the faculty/tutor at any stage in the course duration via email (tejas@nitt.edu) ONLY. Face to face discussions by appointment (via email) ONLY.

ATTENDANCE

Students are required to have a minimum of 70% attendance to be eligible to write the final assessment, without which they will have to redo the course.

COMPENSATION ASSESSMENT

Students who have missed any of the assessment tests (I or II) will be provided with one compensation assessment towards the end of the semester as per table above.

ACADEMIC HONESTY & PLAGIARISM

Students are expected to use fair means during assessments, and plagiarism will not be tolerated.

ADDITIONAL INFORMATION

Students are advised to regularly check their webmail, and also contact their class representatives for information and updates regarding the course.

FOR APPROVAL

Course Faculty - Mr. Tejas R **CC-Chairperson - Dr. S Kumaran** **HOD - Dr. S P Kumaresh Babu**