

**DEPARTMENT OF METALLURGICAL AND MATERIALS ENGG.
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

COURSE PLAN – PART I			
Course Title	Materials Science		
Course Code	ICPC12	No. of Credits	3
Department	ICE	Faculty	Dr. R.Mahendran
Pre-requisites Course Code	---	Section (if, applicable)	A
Course Coordinator(s) (if, applicable)		Department	MME
Other Course Teacher(s)/Tutor(s) E-mail	--	Telephone No.	9994904601 Intercom : -
Course Type	<input checked="" type="checkbox"/> Core course <input type="checkbox"/> Elective course		

Syllabus (approved in BoS)

Introduction to crystal structure of materials, density computations, polymorphism and allotropy, Miller indices for crystallographic planes and directions, isotropy and anisotropy with respect to material properties. X-ray diffraction for determination of crystal structure. Defects in solids: point, line and planar defects and their effect on properties of materials. Phase diagrams, mono component and binary systems, Interpretation of phase diagrams, the Gibbs phase rule, the iron carbon system.

Development of micro structure under equilibrium and non-equilibrium cooling. Time-temperature transformation curves and their applications. Mechanical properties of materials: elasticity, elastic and plastic behaviour, stress-strain relationship, fatigue and creep, strengthening mechanisms and fracture. Thermal properties: heat capacity, thermal expansion, thermal conductivity and thermal stresses.

Electrical properties of materials: Electron energy band structures for solid materials, conduction in terms of band structure and atomic bonding models. Intrinsic and extrinsic semiconductors, the temperature variation of conductivity and carrier concentration. Electrical properties of polymers. Dielectric behaviour, Ferro electricity and Piezoelectricity.

Magnetic properties, diamagnetic, paramagnetic, Ferromagnetic, anti-ferromagnetic, ferromagnetic materials and their applications. Influence of temperature on magnetic characteristics of materials. Superconductivity in materials, Optical properties of materials: Absorption, transmission, refraction, reflection; opacity and translucency in materials Absorption, transmission, refraction, reflection; opacity and translucency in materials. Mechanism of photon absorption. Environmental effect on materials.

Zone refining for purification of materials, Synthesis and growth of Group-III-V compounds and their applications. Selection of specific materials required for instrumentation devices, sensors, pumps, valves, pipelines and coatings.

COURSE OBJECTIVES

1. To introduce the basic principles of Material Science and apply those principles to Engineering applications.
2. To teach the structure, properties, advantages and limitations of engineering materials.
3. To introduce the structure-property correlations in materials to develop materials for Demanding engineering applications.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
<ol style="list-style-type: none"> 1. Describe the types in crystallographic structure and phase diagrams of condensed phases. 2. Understand the heat treatment of steels using TTT and CCT. Also, the mechanical properties of the materials. 3. Understand the electrical properties of the materials. 4. Understand the magnetic and optical properties of the materials. 5. Determine the heat treatment conditions required to obtain a given microstructure using TTT diagrams 6. Synthesis of Group III-IV compounds and its applications. 7. Selection of materials and its criteria for the specific applications. 	

COURSE PLAN – PART II**COURSE OVERVIEW**

- Introduction to crystal structure of materials density computations, polymorphism and allotropy, Miller indices for crystallographic planes and directions
- Isotropy and anisotropy with respect to material properties. Crystal determination by XRD
- Defects in solids: point, line and planar defects and their effect on properties of materials.
- Phase diagrams: mono/binary systems, Interpretation of phase diagrams, the Gibbs phase rule, the iron carbon system.
- Development of micro structure: Equilibrium and non-equilibrium cooling, TTT, CCT and applications.
- Properties and its mechanisms of materials: Mechanical and thermal properties.
- Electrical properties of materials: Electron energy band structures, Intrinsic and extrinsic semiconductors, the temperature variation of conductivity and carrier concentration. Electrical properties of polymers. Dielectric behaviour, Ferro electricity and Piezoelectricity.
- Magnetic properties: Diamagnetic, paramagnetic, Ferromagnetic, anti-ferromagnetic, ferromagnetic materials and their applications.
- Superconductivity in materials, Optical properties of materials.

- Electrical properties of materials: Electron energy band structures, Intrinsic and extrinsic semiconductors, the temperature variation of conductivity and carrier concentration. Electrical properties of polymers. Dielectric behaviour, Ferro electricity and Piezoelectricity.
- Magnetic properties: Diamagnetic, paramagnetic, Ferromagnetic, anti-ferromagnetic, ferromagnetic materials and their applications.
- Superconductivity in materials, Optical properties of materials

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	3 rd to 4 th week, July,19	Introduction to Crystal structures, Defects in materials	Chalk and Board, Power point
2	1 st to 3 rd week August,19	Phase diagrams, TTT, CCT	Chalk and Board
3	4 th week, Aug,19, 1 st week Sep., to 3 rd week Sep,19	Mechanical and Thermal properties	Chalk and Board, Power point
4	4 th week Sep,19 and 1 st – 3 th week Oct,19	Magnetic properties, Optical properties and Environmental effect on materials.	Chalk and Board, Power Point
5	4 th Oct, 1 st –2 nd week Nov,19,19	Zone refraining, Synthesis and Growth III-IV compounds, Selection of materials	Chalk and Board, Power Point

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment - I	1 th week September'19	1 hr	20
2	Assessment - II	1 st week October'19	1 hr	15
3	Assessment - III	1 st week November'19	1 hr	15
CPA	Compensation Assessment	3 or 4 th week November,19	1hr	20/15
5	Final Assessment	November/December'19	3hrs	50

COURSE EXIT SURVEY


Student's Feedback

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)**MODE OF CORRESPONDENCE (email/ phone etc) :** communication through class reps through mobile and E-mail.**ATTENDANCE :** Minimum attendance 75%. If less than 75% attendance, He /She will be prevented from writing the end semester and re-do the course. Students secured F grade should re-appear the examination as per Institute norms**COMPENSATION ASSESSMENT :** If any students miss the test in genuine ground (production of certificate or letter from the authorized personnel), She / he will be permitted for compensation assessment**ACADEMIC HONESTY & PLAGIARISM :** If any students involve in malpractice in test or final examination, She /he will be prevented from writing the final assessment and awarded F grade and re-do the course (as per Instt. Regulations)**ADDITIONAL INFORMATION**

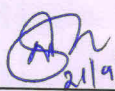
Nil

FOR APPROVAL

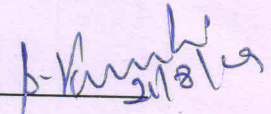
Course Faculty


(R. MAHENDRAN)

CC-Chairperson


21/9/19

HOD


21/8/19