DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech. Welding Engineering, M.Tech. Industrial Metallurgy, M.Tech. Materials Science and Engineering		
Course Title	Physical Metallurgy		
Course Code	MT611	No. of Credits	3
Course Code of Pre-requisite subject(s)	Nil		
Session	Jul 2022	Section (if, applicable)	NA
Name of Faculty	Dr. V. Karthik	Department	MME
Email	karthikv@nitt.edu	Telephone No.	9788444987
Name of Course Coordinator(s) (if, applicable)			
E-mail		Telephone No.	
Course Type	✓ Core course	☑ Elective course	

Syllabus (approved in BoS)

Introduction to engineering materials. Atomic structure and inter atomic bondings, theoretical concept of crystalline materials – types of packing, voids and packing factors for each of the packings, concept of alloy design using lattice positions and intristitial voids. Planes and directions and imperfections in solids. Polymorphism and allotropy.

Diffusion, energetic of solidification Nucleation and growth-dealing homogeneous and heterogeneous nucleations and growth of solids, dendritic growth in pure metals, constitutional super cooling and dendritic growth in alloys.

Phase diagrams – solid solution –types, Hume –Rothery rule. Phase diagrams – Binary- types – Lever rule. Solidification of different types of solid solutions – Iron-Carbon diagram – Effect of alloying element on Iron-carbon diagram. Ternary phase diagrams- Understanding of isotherms and isopleths.

Het treatment of ferrous alloys; Annealing, Normalising, TTT and CCT diagrams, Hardening – hardenability measurements, tempering. Thermo mechanical treatments. Heat treatment furnaces – atmospheres – quenching media – case hardening techniques.

Basic concept of dislocations their types and its interactions. Dislocations and strengthening mechanisms strengthening by grain-size reduction, solid solution strengthening, strain hardening, dispersion hardening and other recent modes of hardening.

COURSE OBJECTIVES

To develop an understanding of the basis of physical metallurgy and correlate structure of materials with their properties for engineering applications.

COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
At the end of the course student will be able to:	
1. Describe the basic crystal structures (BCC, FCC, and HCP), recognize other crystal structures, and their relationship with the properties	**1,4,5,6**
2. Define and differentiate engineering materials on the basis of structure and properties for engineering applications	**1, 4, 6, 8, 11**
3. Select proper processing technologies for synthesizing and fabricating different materials	**1,3,5**
4. Analyse the microstructure of metallic materials using phase diagrams and modify the microstructure and properties using different heat treatments	**1,3,5**

COURSE PLAN – PART II

COURSE OVERVIEW

The course starts with introduction to crystal structures, imperfections and diffusion. Discuss about the phase diagrams, heat treatment of ferrous alloys and strengthening mechanisms.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	I-III	Introduction to crystal structures and crystal imperfections	Chalk and talk + power points + animated/real videos
2	IV-VI	Diffusion, nucleation and growth concepts	
3	VI-IX	Phase diagrams with examples	
4	X-XII	Heat treatment of ferrous alloys	
5	XIII-XIV	Strenthening Mechanisms	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration (mins)	% Weightage
1	Technical Presentation	III-IV	15	10
2	Assignment	VIII	--	10
3	Mid Semester	IX	60	20
4	Video Podcast	XI-XII	5	10
5	Quiz / Assignment	XII	15	10
CPA	Compensation Assessment	XIII	60	20
6	Final Assessment	XVI	120	40

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)
The exit survey will be assessed based on the questionnaire prepared by the class teacher and expected attainment is 75% on 1-10 scale basis
COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)
MODE OF CORRESPONDENCE (email/ phone etc) Email/Mobile/Whatsapp **COMPENSATION ASSESSMENT POLICY** It will be given during XIII week for those who are absent on genuine grounds for the Mid semester examination.
ATTENDANCE POLICY ➢ Institute guidelines will be followed for attendance.
ADDITIONAL INFORMATION
The Course faculty is available for consultation at any time. Students can contact the faculty at any time through whatsapp or phone call or by mail.
FOR APPROVAL
Course Faculty _____ **CC-Chairperson** 19.05.2022 (K. SIVAPRASAD) **HOD** _____ HEAD

METALLURGICAL & MATERIALS ENGG. DEPT
NATIONAL INSTITUTE OF TECHNOLOGY,
TIRUCHIRAPPALLI - 620 015.