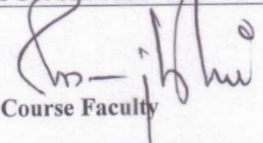




**DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

COURSE OUTLINE TEMPLATE			
Course Title	Phase Transformation and Heat Treatment		
Course Code	MTPC18	No. of Credits	4
Department	MME	Faculty	Dr S KUMARAN
Pre-requisites Course Code	Physical Metallurgy		
Course Coordinator(s) (if, applicable)	Dr S JEROME		
Other Course Teacher(s)/Tutor(s) E-mail	--	Telephone No.	9944434705 Intercom : 3482
Course Type	<input checked="" type="checkbox"/> Core course <input type="checkbox"/> lective course		
COURSE OVERVIEW			
<p>Introduction and classification of phase transformations. Diffusion in solids: phenomenological approach and atomistic approach. Nucleation and growth theories of vapour to liquid, liquid to solid, and solid to solid transformations; homogeneous and heterogeneous strain energy effect during nucleation; interface-controlled growth and diffusion controlled growth; overall transformation kinetics.</p> <p>Principles of solidification, evolution of microstructures in pure metals and alloys. Precipitation from solid solution: types of precipitation reactions, crystallographic description of precipitates, precipitation sequence and age hardening, spinoidal decomposition.</p> <p>Iron-carbon alloy system: iron-carbon diagram, nucleation and growth of pearlite, cooling of hypo-eutectoid, eutectoid, and hyper-eutectoid steels, development of microstructures in cast irons. Heat treatment of steels: TTT and CCT diagrams, bainitic transformation, martensitic transformation, hardenability, role of alloying elements in steels</p> <p>Conventional heat treatment of steels. Massive transformation. Order-disorder transformation. Phase transformations in and heat treatment of some common non-ferrous metals and alloys</p> <p>Types of furnaces and furnace atmospheres; quenching media; types of quenching, mechanism of quenching, quenching characteristics, choice of quenchants; surface hardening of steels- carburizing, nitriding, carbonitriding and others.. Various thermo-mechanical treatments; Designing for heat treatment, defects in heat treated parts, causes for the defects in heat-treated parts and remedies</p>			

COURSE OBJECTIVES				
To study the phase changes that occurs during both thermal and thermo mechanical treatments				
COURSE OUTCOMES (CO)				
Course Outcomes				Aligned Programme Outcomes (PO)
1. Describe the mechanisms responsible for atomic and molecular movements in condensed phases				[1, 2]
2. Understand the heat treatment of steels using TTT and CCT				[1, 2]
3. Determine the heat treatment conditions required to obtain a given microstructure using TTT diagrams				[1, 2, 8, 11]
4. Relate solid state atomic mobility to transport phenomena in materials				[5, 8, 11]
5. Understand the different kinds surface hardening of steels				[2, 11]
COURSE TEACHING AND LEARNING ACTIVITIES				
S.No.	Week	Topic	Mode of Delivery	
1	2 nd to 4 th week, January	Liquid to Solid Transformation	Chalk and Board	
2	1 st to 3 rd week February	Structural Evolution and Precipitation	Chalk and Board, Power Point	
3	4 th week Feb., to 3 rd week March	Fe-C Phase Diagram and TTT	Chalk and Board	
4	4 th week March to 2 nd week April	Heat Treatment processes	Chalk and Board, Power Point	
COURSE ASSESSMENT METHODS				
S.No.	Mode of Assessment	Month (s)	Duration	% Weightage
1	Assignment	2 nd week February	--	10
2	Mid-term test	2 nd week March	1hr 30min	30
3	Seminar / Term Paper	1 st week April	15min/student	10
4	End Semester	3 rd /4 th week April	3hrs	50

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc
1. Avner S.H., 'Introduction to Physical Metallurgy', 2nd edition, Tata McGraw Hill, 1984
2. Lakhtin Y., 'Engineering Physical Metallurgy', 2nd Edition, MIR Publishers, 1979
3. Prabhu Dev K. H., 'Handbook of Heat Treatment of Steel', TMH, 1988

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)		
Student's feedback		
COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)		
Minimum attendance 75%. If less than 75% attendance, He /She will be prevented from writing End Semester Exam and re-do the course. Students secured F grade will re-appear the examination as per Institute norms		
ADDITIONAL COURSE INFORMATION		
Nil		
FOR SENATE'S CONSIDERATION		
 Course Faculty	 CC-Chairperson	 HOD