DEPARTMENT OF METALLURGICAL AND MATERIALS ENGG.

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	THERMODYNAMICS AND KINETICS		
Course Code	MT 653	**No. of Credits**	4
Department	MME	**Faculty**	Dr. D. Nagarajan
Pre-requisites Course Code	---	**Section (if, applicable)**	Materials Science and Engineering
Course Coordinator(s) (if, applicable)		**Department**	MME
Other Course Teacher(s)/Tutor(s) E-mail	--	**Telephone No.**	76396-41307 Intercom: 3712
Course Type	✓ **Core course** ☐ **Elective course**		

Syllabus

Introduction to thermodynamics and kinetics – different approaches – emphasis on metallurgical thermodynamics, transport phenomena and applications

Laws of thermodynamics and related applications – concepts of free energy and entropy– criteria for spontaneity

Introduction to solutions – partial molar entities – Gibbs Duhem relations -thermodynamic aspects of metallic solutions and salt melts – Raoult's Law and Henry's Law - regular and quasi chemical models

Thermodynamic aspects of phase diagrams – similarity in thermodynamic approach towards different classes of materials – thermodynamic aspects of defect formation in metals and ceramics – approaches used in chemical modeling

Principles of metallurgical kinetics – reaction rates and reaction mechanisms – overview of mass transfer, heat transfer and fluid flow – related applications in metallurgical processes – role of transport phenomena in mathematical and physical modeling

COURSE OVERVIEW

To introduce the principles of thermodynamics and kinetics, and illustrate their applications in the design of alloy systems.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)

1.	To understand the basics of metallurgical thermodynamics and have knowledge of contemporary issues related to the industrial processes.		[1,2,3,6]
2.	Knowledge of phase equilibria in two-component and multi-component systems and estimate the thermodynamic properties of an alloy in solid or liquid state of ideal and real mixture		[1,4,5]
3.	Predict the phase transformations in an alloy system with an understanding of phase diagrams.		[7,10,11]

COURSE PLAN – PART II

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	1st & 2nd week of August	Introduction to thermodynamics and kinetics – different approaches – emphasis on metallurgical thermodynamics, transport phenomena and applications	Chalk and Talk
2	3rd & 4th week of August	Laws of Thermodynamics and related applications-concepts of free energy and entropy-criteria for spontaneity	Chalk and Talk
3		Numerical Problem Practice	Chalk and Talk
4	1st week of September	Introduction to solutions – partial molar entities – Gibbs Duhem relations	Chalk and Talk
5	2nd week of September

3rd & 4th week of September | Thermodynamic aspects of metallic solutions and salt melts – Raoult's Law and Henry's Law - regular and quasi chemical models | Chalk and Talk |
| 6 | | Numerical Problem Practice | Chalk and Talk |
| 7 | 1st of October

2nd & 3rd week of October | Thermodynamic aspects of phase diagrams – similarity in thermodynamic approach towards different classes of materials – thermodynamic aspects of defect formation in metals and ceramics – approaches used in chemical modeling | Chalk and Talk |
| 8 | 4th week of October | Principles of metallurgical kinetics – reaction rates and reaction mechanisms | Chalk and Talk |
| 9 | 1st & 2nd week of November | Heat transfer and fluid flow – related applications in metallurgical processes – role of transport phenomena in mathematical and physical modeling | Chalk and Talk |

COURSE ASSESSMENT METHODS:

Sl. No	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment - I	2nd week of September	1 ½ hr	25
2	Assessment - II	4th week of October	1 ½ hr	25
3	Assignment	1st week of November	2 weeks' time for submission	10
4	Final Assessment	4th week of November or 1st week of December.	3 hrs	40

COURSE EXIT SURVEY:
Student's online feedback.

COURSE POLICY:

MODE OF CORRESPONDENCE: Any communication to the faculty or student will be made through the class reps through mobile or e-mail.
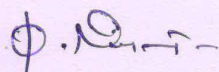
ATTENDANCE: As per Institute norms, a minimum attendance of 75% is expected in the course. If the attendance is less than 75%, the student will be prevented from writing the end semester and has to redo the course. Students securing 'F' grade should re-appear the examination as per Institute norms.

COMPENSATION ASSESSMENT: Prior permission is sought from the faculty for any absence during the exam, unless it is a medical emergency. If any student misses the test in genuine ground (production of certificate or letter from the authorized personnel), he/ she will be permitted for compensation assessment.

ACADEMIC HONESTY & PLAGIARISM: If any student involves in malpractice during the examination, appropriate disciplinary action will be taken by the competitive authority.
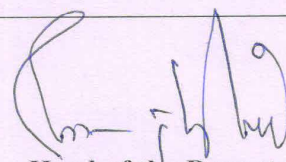
ADDITIONAL INFORMATION

Nil

FOR APPROVAL

Course Faculty	**Class Committee Chairman**	**Head of the Department**
(Dr. D. Nagarajan)	**(Dr. N. Ramesh Babu)**	**(Prof. S. Kumaran)**

27.08.19