



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

COURSE PLAN – PART I			
Name of the programme and specialization	B.TECH. METALLURGICAL AND MATERIALS ENGINEERING		
Course Title	Metallurgical Thermodynamics and kinetics		
Course Code	MTPC11	No. of Credits	4
Course Code of Pre-requisite subject(s)	Nil		
Session	July 2022	Section (if, applicable)	NA
Name of Faculty	Dr. -Ing Prince Gideon Kubendran Amos	Department	MME
Email	prince@nitt.edu	Telephone No.	9843550816
Name of Course Coordinator(s) (if, applicable)			
E-mail		Telephone No.	
Course Type	<input checked="" type="checkbox"/> Core course <input type="checkbox"/> Elective course		
Syllabus (approved in BoS)			
<p>Types of system, state of a system, state properties- First law of thermodynamics; heat of reaction, heat of formation, standard heats, heat of transition; Hess's law of heat summation. Second law, entropy of irreversible processes, combined statements of 1st and 2 nd laws - Maxwell's relations, Clausius- Clapeyron equation, Trouton's rule, Gibb's - Helmholtz relations. Third law of thermodynamics, relation between CP and CV, Nernst heat theorem, equilibrium constant, Van't Hoff equation, concept of fugacity, activity, mole fraction. Thermodynamics of solutions, Gibb's Duhem equation, partial molar properties of mixing, concept of chemical potential, ideal solution, Raoult's law, Henry's law; nonideal solution, excess functions, regular solutions. Sievert's law-residual gases in steel-properties and functions of slags, slag compositions, structure of molten slags, molecular theory, concept of basicity index, ionic theory; thermodynamics of slag- metal reactions. Kinetics: First, Second and third order reactions, Arrhenius equation - activation energy, Determination of order of the reaction, rate constants and rate limiting steps. Numerical problems on the concepts mentioned in all the above units.</p>			
COURSE OBJECTIVES			
<p>To learn the basic principles and concepts of thermodynamics, in terms of various laws pertinent to gaseous, liquids (solutions) and solid systems and their significance in various of metallurgical processes</p>			

COURSE OUTCOMES (CO)				
Course Outcomes				Aligned Programme Outcomes (PO)
At the end of the course student will be able to:				
1. Matter, energy, heat- Types of system, state function, first law of thermodynamics, its significance, standard heats of formation, laws of thermochemistry- Numerical examples.				1, 2
2. Nature and second law of thermodynamics-various statements, concept of entropy, Maxwell, Clausius-Clapeyron equations, Trouton's rule, Gibbs Helmholtz relation and their importance - Numerical examples.				1, 2
3. The need for third law of thermodynamics-statement and its relevance to perfectly pure crystalline substances - Numerical examples.				1, 2
4. Thermodynamics of solutions; Gibbs-Duhem relation-partial molar properties-chemical potential Raoult's law, Henry law, on-ideal solutions, excess functions and regular solutions- Numerical examples.				1, 2
5. Thermodynamics of gases in metals: Sievert's law and its significance, thermodynamics of slag –metal interactions – numerical examples.				4, 7, 12
6. Kinetics: order of a reaction, rate constants and rate limiting steps –Numerical examples				3, 4, 5, 6, 12
COURSE PLAN – PART II				
COURSE OVERVIEW				
Understanding the basic principles and concepts of thermodynamics, in terms of various laws				
COURSE TEACHING AND LEARNING ACTIVITIES				
S.No.	Week/Contact Hours	Topic	Mode of Delivery	
1	I -II	Terminologies	Conventional	
2	III	Zeroth and First Law		
3	IV-VI	Entropy and Second Law		
4	VII-IX	Third Law		
5	X-XI	Thermodynamics of Solution		
6	XII	Kinetics		
COURSE ASSESSMENT METHODS (shall range from 4 to 6)				
S.No.	Mode of Assessment	Week	Duration (Hours)	% Weightage
1	Assignment	As per the Institute's time table	7 (Days)	25
2	Mid - Semester		1	25

3	Review Communique		0.5 (30 minutes)	20
CPA	Compensation Assessment		1	25
4	Final Assessment		2	30

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 XI week for those who are absent on genuine grounds for the Mid semester examination or quiz.

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



HOD