

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE TEMPLATE

Course Title	METALLURGICAL THERMODYNAMICS		
Course Code	MTPC13	No. of Credits	4
Department	MME	Faculty	S.RAJAVIGNESH
Pre-requisites Course Code			
Course Coordinator(s) (if, applicable)			
Other Course Teacher(s)/Tutor(s) E-mail	<u>rajas@nitt.edu</u>	Telephone No.	09585335666
Course Type	Core course <input checked="" type="checkbox"/>	Elective course <input type="checkbox"/>	

COURSE OVERVIEW

This course will introduce the basic laws of thermodynamics the multiple approaches to thermodynamics, from the bulk property point of view and from the atomistic point of view concepts such as the theory of solutions, free energy, entropy, criteria for equilibrium and conditions for feasibility.

COURSE OBJECTIVES

COURSE OBJECTIVES

To learn the basic principles and concepts of thermodynamics, in the domain of metallurgy and materials; and to learn about equations and their applications; and to appreciate that metallurgical thermodynamics is a knowledge base with abundant applications

COURSE OUTCOMES (CO)			
Course Outcomes			Aligned Programme Outcomes (PO)
1. Understand the basic laws of thermodynamics			1,2
2. Understand the multiple approaches to thermodynamics, from the bulk property point of view and from the atomistic point of view			1
3. Understand concepts such as the theory of solutions, free energy, entropy, criteria for equilibrium and conditions for feasibility			1,2
4. Obtain the skill to use metallurgical thermodynamic concepts and equations for understanding phase diagrams, phase transformations, theory of solutions			1,5
5. Obtain problem solving skills in order to improve / modify industrial processes, esp. In extraction metallurgy, liquid metal treatment and in heat treatment			1,2,8,11
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week	Topic	Mode of Delivery
1	1,2nd week	Types of system, state of a system, state properties - First law of thermodynamics; heat of reaction	Chalk and talk
2	3 rd , 4 th week	heat of formation, standard heats, heat of transition; Hess's law of heat summation.	Chalk and talk
3	5 th week	Assessment I	
	6 th week	Second law, entropy of irreversible processes, combined statements of 1st and 2nd laws - Maxwell's relations, Clausius - Clapeyron equation, Trouton's rule, Gibb's - Helmholtz relations	Chalk and talk
4	7 th week	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; non ideal solution, excess functions, regular solutions.	Chalk and talk

5	8 th week	Assessment -ii	
6	9 th week	. Thermodynamics of solutions, Gibb's Duhem equation, partial molar properties of mixing, concept of chemical potential, ideal solution, Raoult's law, Henry's law; non ideal solution, excess functions, regular solutions.	Chalk and talk
6	10 th and 11 th week	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	Chalk and talk
7	12 th week	End assessment	

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle test-I	5 th week	1 hour	20%
2.	Cycle test-II	8 th week	1 hour	20%
3.	Semester Exam	11 th week	3 hour	50%
4	Assignments			10%

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. Tupkary R.H., 'Introduction to Metallurgical Thermodynamics', 1st Edition, TU Publishers, Nagpur, 1995
2. Upadhyaya G.S., Dube R.K., 'Problems in Metallurgical Thermodynamics and Kinetics', 1st Edition, Pergamon Press, 1977

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

An exit survey will be taken from the student at the end of the semester through a questionnaire on coverage of syllabus, usefulness of course plan, teaching efficiency, etc..

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. Examination

- a) Students who have missed the first and second assessment or both can register the re-assessment which shall be conducted after the completion of the assessment and before the end assessment.
- b) the re assessment shall be conducted for 20 marks comprising the syllabus of both first and second assessment
- c) students should submit assignments before last date of submission. in case students fails to submit their assignments within last date of submission, he /she will get zero mark for the particular assignment

2. Attendance

- a) the minimum attendance for appearing for the semester examination is 75%
 - b) those students, whose attendance falls below 75% but above 50% in a subject, shall submit assignments before the end assessment
 - c) the students who having attendance less than 50% has to redo the course in next semester
3. The institute follows relative grading with flexibility to decide the mark ranges for grades. All assessment of a course will be done on the basis of marks.
4. the passing mark should be $x/2$ or $x_{max}/3$ whichever is less where x is the mean of the class and x_{max} is the maximum mark in the class

5 the letter grades and the corresponding grade points are as follows

letter	S	A	B	C	D	E	F	X	
grade	10	9	8	7	6	5	0	--	

- a) Students scoring less than the passing minimum mark in the assessment defined in the course plan shall be deemed to have not successfully completed the course and be given an 'F' grade.
- b) Students awarded F grade may opt for formative assessment
- c) A students who earns a minimum of 5 grade points in a course is declared to have successfully completed the course.
- d) Students who have not satisfied the attendance requirements of the course and found malpractice during assessment shall be awarded a 'X' grade for the course.
- e) Students awarded X grade may REDO the course or opt for formative assessment
- f) If the students fails to appear end assessment due to medical reason can register for one more end-assessment after approval from course teacher and H.o.d . The special end assessment will be conducted within ten days from reopening of institute for next semester. Students should register their names with course teacher to appear for special end assessment. Grade issued as per the guidelines followed for his/her batch students.

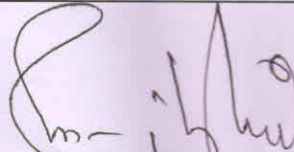
ADDITIONAL COURSE INFORMATION

Students can make a call or email to rajas@nitt.edu at any stage of course duration in case he/she finds difficulty in understanding the concepts.

FOR SENATE'S CONSIDERATION



Course Faculty
S.Rajavignesh



CC-Chairperson
Dr.S.Kumaran



HOD
Dr.S.P Kumaresh Babu
Dr. S.P. KUMARESH BABU
HEAD
DEPT. OF METALLURGICAL & MATERIALS ENGG.
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI - 620 015.