Course Name						
PHASE EQUILIBRIUM DIAGRAMS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET224E	4	2,5	4	2	1	-

Department/Program	Metallurgical and Materials Engineering		
Course Type	Required	**Course Language**	ENGLISH
Course Prerequisites	None		

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
		100		

Course Description	One-component systems, phase rule, two-component systems; eutectic, peritectic, eutectoid, peritectoid reactions, partial and complete solid solutions, intermediate phases, lever rule, cooling curves, three-component systems without solid solution; crystallization path, application of phase rule and lever rule, alkemade lines and triangles, use of phase diagrams in material technologies.
Course Objectives	1. To provide the concepts of phase equilibrium and phase transformations 2. To provide the analysis and interpretation of phase diagrams 3.To give an ability to apply knowledge of phase diagrams on material science and technologies.
Course Learning Outcomes	Students who pass the course will be able to; 1. Use the thermodynamic knowledge in phase diagrams 2.Interpret and draw pressure-temperature and temperature-composition diagrams 3.Understand the concept of phase transformations and its possible effects on the properties of materials 4.Interpret the microstructure of materials 5.Use phase diagrams in the production and heat treatment of metallic and ceramic materials
Textbook	Hummel, F.A., “Introduction to Phase Equilibria in Ceramic Systems”, New York Marcel Dekker Inc., 1984
Other References	Alper, M., “Phase Diagrams: Material Science Tech., Volume I, II, III”, New York: Acad. Press, 1970 Gordon, P., “Principles of Phase Diagrams in Material Systems”, New York: McGraw-Hill Book Company, 1968.
Homework & Projects	
Laboratory Work	
Computer Use	
Other Activities	

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	2	40
	Quizzes	-	-
	Homework	-	-
	Projects	-	-
	Term Paper/Project	-	-
	Laboratory Work	-	-
	Other Activities	-	-
	Final Exam	1	60

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Definition of phase, component, system, and phase equilibrium. One component systems	1
2	One-component systems, phase rule	2,3
3	Two-component systems ;continuous and partial solid solutions, eutectic reaction	2,3
4	Two-component systems; intermediate phases, peritectic reaction	2,3
5	Two-component systems; eutectoid and peritectoid reactions	2,3
6	Two-component systems; eutectoid and peritectoid reactions	2,3
7	Two-component systems; liquid immiscibility, monotectic reaction	2,3
8	Two-component systems; order-disorder transformation,	2,3
9	Ternary systems without solid solutions; crystallization regions of the phases, ternary eutectic and peritectic reactions	2,3
10	Ternary systems without solid solutions; alkemade lines and triangles	2,3
11	Ternary systems without solid solutions; crystallization order, application of phase rule and lever rule	2,3
12	Ternary systems without solid solutions; crystallization order, application of phase rule and lever rule	2,3
13	The use of phase diagrams in the sintering and heat treatment of metals and ceramics,	3
14	The use of phase diagrams in the sintering and heat treatment of metals and ceramics	3

Relationship between the Course and METALLURGICAL AND MATERIALS ENGINEERING **Curriculum**

	Program Outcomes	Level of Contribution		
		1	**2**	**3**
1	Ability to apply the knowledge of mathematics, science and engineering principles to solve problems in metallurgical and materials engineering (ABET:a)			x
2	Ability to characterize materials using standard and/or self designed experimental methods and to evaluate the results (ABET:b)			
3	Ability to design a system or a process, taking into consideration of the desired specifications, quality, ethics and environment. (ABET:c)			
4	Ability to communicate both orally and in the written form and to take part in, and provide leadership of the teams in the elucidation of engineering problems; (ABET:d, g)			
5	Ability to define, formulate and solve engineering problems in the development, production, processing, protection and usage of engineering materials. (ABET:e)			x
6	An understanding of professional and ethical responsibilities(ABET:f)			
7	An understanding of current/contemporary issues and impact of engineering solutions in broad cultural, national and global levels;. (ABET:h, j)			
8	A comprehension of the nature of engineering progress closely linked with the development of new materials and production processes. An ability to engage in life-long learning and a recognition of its necessity (ABET:i)			x
9	Ability to use essential tools and techniques of modern engineering in the development, production, processing, protecting of the existing and new engineering materials. (ABET:k)		x	

1: Little, 2. Partial, 3. Full

Course relationships with major elements of the field and material classes

		Level of Contribution		
		1	**2**	**3**
MAJOR ELEMENT OF THE FIELDS	STRUCTURE			**x**
	PROPERTIES		**x**	
	DESIGN EXPERIMENT/ANALYSE DATA	**x**		
	PROCESSING			**x**
	COST/PERFORMANCE			
	QUALITY/ENVIRONMENT			
	DESIGN PROCESS OR PRODUCT		**x**	
MATERIAL CLASSES	METAL			**x**
	CERAMICS			**x**
	POLYMERS			
	COMPOSITES			

1: Little, 2. Partial, 3. Full

Prepared by	**Date**	**Signature**
Asst. Prof. Dr. Nuri SOLAK	December 2020	