

<b>Number of units</b> 6	<b>T</b> 4	<b>Pr</b> 2	<b>Th</b> 2	Number of weekly hours	Annual System 30 weeks	Al-Esra'a University College Department: Engineering of Refrigeration and Air Conditioning Technologies
				<b>Engineering materials</b>		Second stage
<b><u>Course Objective</u></b>						
Teaching the student, the most important materials :metals and non-metals used in manufacturing of air conditioning and refrigeration devices and study their crystalline structure and mechanical properties.						

<b>Week</b>	<b>Topics</b>	<b>Practical subject</b>	<b>Notes</b>
1	Crystalline and non Crystalline Materials	,Hardness(Vickers ,Brinell ,Rockwell, and Michro hardness tests	
2	Metallic crystal structures		
3	crystallographic directions ,crystallographic planes-Types of crystal structure, Packing factor		
4	Bonds ,metallic bond ,ionic bonds ,covalent bond ,vanderwaals bond , hydrogen bond		
5	Defects ,point defects ,dislocations ,linear defects ,planar defects		
6	Fabrication of metals ,forming operations ,casting	Tensile test, Elastic Deformation ,stress _strain behavior	
7-8	Mechanical properties ,Hardness(Brinell hardness ,Vickers hardness , Rockwell hardness )		
9	Tensile test	Impact Tests	
10	Impact test		
11	Creep test	Creep Tests	
12	Fatigue test		
13	Heat –treatment of metals and non-metals		
14	Solidi faction. Solid solution - Phase –diagrams for binary alloys		
15	Complete solubility in both liquid and solid states.	Grinding and Polishing samples for Microscopic Technique	
<b>Half-year Break</b>			
16	Complete solubility in liquid state and complete	Microscopic Technique	

	insolubility in solid state	for The Iron _Carbon	
17	Complete solubility in liquid state and limited solubility in solid state		
18	Iron making		
19	Steel making	Microscopic Technique for Aluminum Alloys	
20-21	Iron –carbon systems		
22	Types of iron- carbon systems		
23-24	Ferrous and non ferrous alloys in air conditioning and refrigeration equipments	Microscopic Technique for Copper Alloys	
25-26	coppers alloys		
27-28	Aluminum alloys	Welding Defects in cooling pipes	
29-30	Corrosion and corrosion prevention		