Number of units ٦	T ٩	Pr ٩	Th -	Number of weekly hours	Annual System 30 weeks	**Al-Esra'a University College Department: Engineering of Refrigeration and Air Conditioning Technologies**
				WorkShops		**First stage**

Course Objective

Acquainting the basic manual skills for machining, manufacturing and maintenance using different tools and instruments.

week	Topics	Lab. Experiment Assignment	Notes
1-2	**Foundry work shop:-** Metal casting and its importance , purpose of using casts in industry, casting work shop equipment's, industrial safety regulation in works shop, making sand mold for one piece pattern and cores types , resources of sand and mould properties, additives materials, mixing processes and percentage of quality , using sand mixing, sand treatment and sand handling equipments, making manual sand mold for one piece cast.		
3-4	Making sand mold for one piece cast with runner and risers, cast cleaning make core and baking it in baking furnace, make sand mold for two pieces pattern with core.		
5-6	making sand mold with core, melting the metal , pouring the metal . take out the cast from the mold, cleaning the cast, Melting furnaces of metals: types , specifications, its uses (rotary, crucible) heat treatment and cat inspection, visual surface defects and its causes . Measuring cast dimension and insure equal to original dimension.		
7-8	**Filing Work Shop:-** Vernier types, measuring methods , measuring height and depth, sketching process on sheet metal plate, tools used, scratching pointer, strip divider, bended edge divider, 90 degree square ruler, bended rulers,		
9-10	Files, files and filling process: filing types and its specifications, clamp vices types, processes of fixing work piece on it, the uses of different types of fillings, filing cleaning process, filling methods, exercises on scratching method and simple file.		
11-12	Saw cutting , hand saw, saw blade, fixing the saw blade, the saw blade condition available for sawing process, exercises for saw cutting process.		

13-14	**Lathe Work Shop:-** Lathe machine, specifications its uses, accessory lathe parts , lathe operation, lathe cutting tools types , uses of measuring instruments.		
15-16	Turning Processes:- Facing , simple steps, learning using measuring instruments.		
Half – Year Break			
17-18	Internal and external taper turning, making exercises for both methods.		
19-20	**Welding work shop:-** work shop safety, safety requirement, Gas welding: equipment, assembly and regulation, welding tools, gases used, specifications, fluxes, fillers, flame types and its uses, flame ignition, flam regulation.		
21-22	Corner and butt welding training exercises.		
23-24	Oxygen cutting: equipments, safety, requirement, cutting exercises.		
25-26	Arc welding: welding machine and equipments, safety regulation, arc ignition.		
27-28	Making exercises, making beaks on plates, using different kinds of electrodes		
29-30	Edge preparation, making exercises of T joints.		

Refrigeration& Air Conditioning work shop: (**3 hours** weekly)

Week	Topic	Lab. Experiment Assignment	Notes
1	Identify the (manual tools that used in A\C installation process-compression cycle for some domestic and commercial device –pipe that used in A\C system)		
2-3	Copper tubes cutting –iron tubes cutting- aluminum tubes cutting) and the process that must be done after cutting- bending by using different methods		
4-5	Type of rod that used in welding the copper tube and the process that must be done before welding process welding (copper\silver and copper\iron)		
6-8	Welding on cold, welding holes in aluminum plate, connect pipe		
9-10	Identify on compressor type, suction and discharge line and open compressor and its main parts		

11	Leak indictor and the method to find it		
12-14-15	Charge and vacuum process, charge by using charge line and charge refrigerator, air-condition unit and some commercial device		
Half-year Break			
16-17	Identify on main electric parts in compression cycle –overload-thermostat-and type of relay		
18-19	Type the water pipe and its connect, identify on (condenser that cooled by water- cooling tower and water pump)		
20-21	Metal work: identify the tools that used in And exercise on cutting and bending plate		
22-23	Exercise to learn (type of bending –parts that used to connect ducts and rectangular duct)		
24-25	Exercise to make sample for change the volume flow rate in the duct.		
26-27	Exercise to make (elbow with small scale)		
28-29-30	Exercise to make (divided region, circular ,rectangular holes and diffuser)		