Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	٠٢٠٢٠٠١١٥
Course Title	Fluids and Hydraulic Machines
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Short Description:

Fluid properties, fluid static's, fluid motion, continuity equation, momentum principle, energy principle, Fluid flow in pipes, pipe friction, introduction to Pumps, Types ,Selection and application of pumps.

Course Objectives:

1- Develop competence in use of conservation laws (mass, energy, momentum) for analysis, design, selection, and operation of flow measuring devices, of open and closed water and waste water conveyance systems, and of hydraulic machines (pumps, turbines).
2- Utilize methods for risk and reliability analysis along with engineering economics in selecting components and systems.
3- Strengthen understanding of phenomena (e.g., cavitation, pressure/flow relations, losses), devices, components and systems with laboratory experiments and field trips.
4- Improve communication skills through report writing.
5- Development of dimensionally consistent equations. Competence with both SI and British Gravitational system of units.
6- Development of mass, momentum, and energy balance.
7- Application of conservation equations for pipe flow, pumping, and simple open channel flow application

Detailed Description:

No.	Unit Title	Unit Content	Hours
1	Introduction	Introduction Units of measurement Fluid physical properties, Density, specific weight, viscosity, surface tension, compressibility	
2	Hydrostatics	fluid pressure, Pascal's law, Pressure variation in static fluid, pressure head, Gage and absolute pressure Pressure measurements (barometer, Manometers, Piezometer, Bourdon tube Engineering applications of hydrostatics	
3	Equilibrium of Floating Bodies	Archimedes principle Met center and met centric height Condition of Equilibrium Oscillation f floating body	
4	Fluid Flow Concept	Types of flow, Laminar and turbulent flow, uniform flow, steady and unsteady flow, incompressible and Compressible flow Fluid energy: internal energy, Kinetic energy, potential energy, pressure energy Fluid motion equations: Continuity, equation of motion for steady flow, Bernoulli equation and its applications Flow measurement: Flow through Orifice, venture, flow over notches, Pitot tube, Rota meter, discharge coefficients	
5	Flow through pipes	Types of flow in pipes, Reynolds number, boundary layer and flow in pipe, loss head in pipes Darcy-Wies formula of head in pipe, relation between friction coefficient and	

No.	Unit Title	Unit Content	Hours
		Reynolds Friction loss in sudden contraction and expansion Friction loss in fittings and valves Velocity distributions in pipe flow, Positive displacement pumps, Gear and screw pumps, Centrifugal pumps. Pumps performance and characteristics curves Power and efficiency calculations	
6	Pumps	Types of Pumps, Principle of operation Pump power and efficiency Net positive section head Reciprocating pumps: Construction, reducing flow fluctuations	
7	Compressors	Types of Air compressors Reciprocating compressors Centrifugal compressors	

Teaching Methods:

1. Lectures
2. Power point presentations
3. Discussion

Books and references:

1. Textbook of Hydraulics, Fluid Mechanics and Hydraulic Machines by R.S. Khurmi, Publisher: S Chand, New Delhi (May 1987), ISBN: 8121901626.

2. Franzini, Fluid Mechanics with Engineering Applications, 10th Edition, McGraw Hill, 2002.

3. Giles R V et al, "Schaum's Outline of Theory and Problems of Fluid Mechanics and Hydraulics", 3rd Edition, McGraw-Hill, 1994.

4. E John Finnemore and Joseph B Franzini, Fluid Mechanics With Engineering Applications, 10th Edition.

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	٠٢٠٢٠٠١١6
Course Title	Fluids and Hydraulic machines Lab
Credit Hours	1
Theoretical Hours	0
Practical Hours	3

Short Description:

Measuring of physical properties of fluids, force on immersed plate, Jet force on plate, Bernoullis equation, Reynolds experiments, flow through orifices, and nozzle venture friction factor.

Course Objectives:

At the completion of this course, each student is expected to be able to: 1. Validate Bernoulli's equation. 2. Measure the fluid Density and viscosity. 3. Determine the Force of pressure on immersed plate. 4. Study the Energy loss and friction coefficient. 5. Perform Flow rate measurements (by orifice and venture). 6. Study the performance of Reciprocating, gear, and centrifugal pumps. 7. Connect pumps in series and parallel and investigate the performance of each configuration.

Detailed Description:

No.	Unit Content	Hours
1	Density and viscosity measurements	
2	Force of pressure on immersed plate	
3	Demonstrating of Bernoulli's equation	
4	Flow rate measurements (flow through 1 orifice and venture)	
5	Energy loss and friction coefficient 1 measurements	
6	Head loss in smooth and rough pipes	
7	Pipe flow, Reynolds number, laminar 1 and turbulent flow in pipes	
8	Flow over notches and Weirs	
9	Pump Testing in Series	
10	Reciprocating pump performance	
11	Gear pump efficiency	
12	Performance of Reciprocation air 1 compressor	
13	Centrifugal Pump Testing	

Teaching Methods:

Laboratory

Books and references: lab-Sheets

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	020200101
Course Title	Principles of Thermal Engineering
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Short Description:

Concepts and definitions, Properties of a pure substance, Work and heat, the first law of thermodynamics, the second law of thermodynamics, entropy, Principles of heat transfer, Steady state conduction, convection, Radiation, Heat exchangers.

Course Objectives:

1. To familiarize the student with basic concepts in thermodynamics and heat transfer and develop an intuitive grasp the subject matter 2. Develop an ability to apply these basic concepts to engineering design problems 3. To provide the student with necessary analytical skills to solve various engineering problems in the field of Thermal Science, such as Power Generation, Heating, and Air conditioning

Detailed Description:

No.	Unit Title	Unit Content	Hours
1	Concepts and definitions	Conceptsanddefinitions:System,controlvolume,properties ,stateofsubstance,processes,cycles,specificvolume,pressu re,temperaturescales,zerothlawofthermodynamics,units	
2	Properties of a pure substance	Propertiesofapuresubstance:vaporliquidsolidphaseequilibri uminapuresubstance,equationofstate,tablesofthermodynami cproperties.	

No.	Unit Title	Unit Content	Hours
3	Work and heat	Workandheat:definitionandunitesofwork,workdoneatthemovingboundaryofasimplecompressiblesystem,definitionandunitesofheat,relationbetweenworkandheat.	
4	The first law of thermodynamics	The first law of thermodynamics :Thefirstlawforthechangeinstateofasystem,internalenergy,enthalpy,constantvolumeandpressurespecificheats,internalenergyandenthalpyandconstantvolumeandpressurespecificheatsforidealgases,thefirstlawofthermodynamicsforacontrolvolume,thesteadystate,steadyflowprocess.	
5	The second law of thermodynamics	The second law of thermodynamics: the engines and refrigerators, reversible process, Carnot cycle, entropy, entropy change of an ideal gas, ploy tropic and adiabatic reversible process.	
6	Principles of heat transfer	Principles of heat transfer: conduction heat transfer, plane wall, plane wall in series and parallel, electro analog for conduction, contact resistance, thermal conductivity, convection heat transfer, radiation heat transfer, combined heat transfer mechanisms.	
7	Steady state conduction	Steady state conduction: steady one–dimensional conduction equation without generation in rectangular coordinates, cylindrical coordinates, steady one–dimensional conduction equation with generation, fins, types of fins, fin efficiency, transient conduction with negligible internal resistance.	
8	Radiation	Radiation: physics of radiation, black body, planks law, Stefan Boltzmann law, radiation properties, kirchoff's law,	

No.	Unit Title	Unit Content	Hours
		gray body, shape factor, radiative exchange between black surfaces.	
9	Heat exchangers	Heat exchangers: types, overall heat transfer coefficient, the log mean temperature difference, heat exchanger effectiveness.	

Teaching Methods:

1. Lectures
2. Power point presentations
3. Discussion

Books and references:

1. Y.A.Cengel,IntroductiontoThermodynamicsandHeatTransfer,Irwin/McGraw2Hill,1997.
2. Fundamentals of Engineering Thermodynamics,M.J.Moran,H.N.Shapiro5thEd,JohnWiley&Sons,Inc.,2004,ISBN:0247 122747122.
3. J.B.JonesandG.A.Hawkins,EngineeringThermodynamics,SecondEdition,JohnWiley& Sons,1986

Course Book:

أساسيات الديناميكا الحرارية الكلاسيكية، الطبعة الثانية ، وايلن وسونتاج، مركز الكتب الأردني

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	020200102
Course Title	Principles of Thermal Engineering Lab.
Credit Hours	1
Theoretical Hours	0
Practical Hours	3

Short Description:

- Pressure–Temperature relation in the saturation region ;Compressor cycles and analyses ; Heat pump performance ; Conduction heat transfer ;Radiation heat transfer ; and Heat exchanger performance

Course Objectives:

At the completion of this course, each student is expected to be able to:

1. To study the relation between the Saturation Pressure- Saturation Temperature relation
2. To investigate the main factors affecting the heat pump performance
3. To study the performance of reciprocating air compressor

Detailed Description:

No.	Unit Content	weeks
1	Saturation Pressure . Saturation Temperature relation	1
2	Heat losses in Heat pump condenser Energy balance of Heat pump	1
3	Coefficient of performance of heat pump Air compressor polytropic work	2
4	Isothermal efficiency of reciprocating air compressor Volumetric efficiency of reciprocating air compressor longitudinal Condition in	2

No.	Unit Content	weeks
	simple bar	
5	Radial Condition in simple bar Conduction in composite bar	2
6	Effect of insulation on conduction heat transfer	2
7	Forced convection heat transfer	2
8	Performance of parallel and counter flow heat exchangers performance of cross flow heat exchangers	2

Teaching Methods:

Laboratory

Books and references: lab Sheets.

Specialization	Air conditioning and refrigeration
Course Number	020203131
Course Title	Heating Systems
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Short Description:

Introduction, Insulation, Heating Load Calculations, Fuel used for Heating Systems, Components Of Hot Water System, Hot Water Heating System, Under floor System, Vapor Heating System, Hot Air Heating System.

Course Objectives:

Upon successful completion of this course, the student should be able to:

1. Understand the basic concepts and components of Heating Systems
2. Identify the Fuel used for heating system.
3. Explain the function and the design of different component of the Heating system.
4. Identify the Hot Water heating System concepts and components.
5. Identify the Under Floor Heating System concepts and components.
6. Identify the Vapor Heating System concepts and components.
7. Identify the Hot Air Heating System concepts and components.
8. Discuss the difference between the various types of Heating systems
9. Estimate the Heating load for different applications.

Detailed Description:

No.	Unit Title	Unit Content	Hours
1	Introduction	▪ Heat Transfer Methods ▪ Heating Methods ▪ Central Heating Systems ▪ General Components of Heating Systems ▪ thermal Units	
2	Insulation	▪ thermal Insulation, Definition ▪ General Properties ,Forms, Thickness of thermal materials ▪ Humidity ,Definition, Sources, Insulation ,Properties, Types ,Methods ▪ Insulation Position	
3	Heating Load Calculations	▪ Definitions ▪ Heating Load ▪ System Capacity ▪ Design Conditions ▪ Heating Load Sources ▪ Walls ▪ Ceilings ▪ Floors ▪ Doors ▪ Windows ▪ Air Change , Air Leakage ,Filtration	

No.	Unit Title	Unit Content	Hours
4	Fuel used for Heating Systems	▪ Fuel Heating Value ▪ Properties of Fuel ▪ Solid Fuel ▪ Gaseous Fuel ▪ Liquid Fuel ,Diesel ▪ Fuel Tank Volume Calculation and Storage Safety	
5	Components Of Hot Water System	▪ Boiler:Function,TypesandClassification,Capacity,Efficiency,Selection ▪ Liquid Fuel Burner :Function ,Types (Evaporating ,Spry ,Selection) ▪ Pipes :Function ,Types ,Materials ▪ Expansion and Feeding Tank: Function, Types, Volume ▪ Circulation Pump :Function, Type, Selection ▪ Radiator s: Function, Types, Selection ▪ Water Cylinder: Function, size calculation and selection ▪ Chimney: Function ,material, size calculation (diameter and height) ▪ Valves: Types, Selection	
6	Hot Water Heating System	▪ Hot Water System: Advantages andDisadvant ▪ Boiler Capacity calculation ▪ Flow Rates ▪ Pipes Size ▪ Floor Heating System	
7	Under floor System	▪ Method of Pipes Installations	

No.	Unit Title	Unit Content	Hours
		▪ Pipes Loops Configuration ▪ Underfloor Heating Design Parameters ▪ Heat Transfer Calculations ▪ Water Flow Rate Calculation ▪ ASHRAE Method ▪ Pressure Drop calculation and Pump Selection ▪ Design Procedure ,Location of the Manifolds	
8	Vapor Heating System	▪ Vapor heating System: Advantages and Disadvantages, Classifications ▪ Pipes ▪ Pressure drop calculation ▪ System Components :Steam boiler, Steam traps ▪ Flow Rates ▪ Pipes Size ▪ Radiator ▪ Valves ▪ Pipes ▪ Gauges and Control Instruments	
9	Hot Air Heating System	▪ Classifications ▪ Air Motion ▪ Ducts Shape ▪ Function of System Components; Furnaces, Ducts, Fan, Filter, Humidifier, Grills	

No.	Unit Title	Unit Content	Hours

Teaching Methods:

1. Lectures
2. Power point presentations
3. Discussion

Books and references:

1. Johnson, Refrigeration and Air Conditioning Technology, 4th Edition, ISBN:0766806677
2. Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler Heating, Ventilating and Air Conditioning: Analysis and Design, 6thEdition, ISBN0247124701525.
3. W.P. Jones, Air Conditioning Engineering, 5thEdition, ISBN0275026507425
4. BillWhitman, Bill Johnson, John Tomczyk, Refrigeration and Air Conditioning Technology, 5thEdition, ISBN1240128376524.
5. Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler Heating, Ventilating and Air Conditioning: Analysis and Design, 6thEdition, JohnWiley, ISBN:0247124701525,2004.

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	020203231
Course Title	Refrigeration Systems
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Short Description:

Introduction, Air Conditioning Processes, Air Conditioning Load Calculations, Central Air Conditioning Methods, Air Ducts and Fans ,Filtration ,Air Cooler Coils , Air Conditioning Equipment.

Course Objectives:

Upon successful completion of this course, the student should be able to:

1. Understand the basic concepts and components of Refrigeration Systems
2. Identify the Simple Vapor Compression Cycle concepts and components.
3. Identify the Absorption Refrigeration System concepts and components.
4. Explain the function and the design of different component of the refrigeration system.
5. Discuss the difference between the various types of Refrigerants
6. Estimate the Cooling load.
7. Understand the Application of Refrigeration.

Detailed Description:

No.	Unit Title	Unit Content	Hours
1	Introduction and Concepts	▪ Refrigeration Concepts ▪ Closed Refrigeration Circuit ▪ Open Refrigeration Circuit ▪ Refrigeration Methods, General Review	
2	Simple Vapor Compressio	▪ Reversible Carnot Cycle ▪ Vapor Refrigeration Machine ▪ Thermodynamic Calculation of the cycle	

No.	Unit Title	Unit Content	Hours
	n Cycle		
3	Refrigerants	▪ Classification and types ▪ Thermodynamic Specification ▪ Refrigerant Usage	
4	Absorption Refrigeration System	▪ Introduction ▪ Simple Absorption ▪ Practical Vapor Absorption ▪ Advantages Of Vapor Absorption System Over Vapor Compression Systems ▪ Coefficient Of Performance ▪ Domestic Electrolux (Ammonia–Hydrogen, Lithium – Bromide)	
5	Cooling Load Estimation	▪ Component Of Cooling Load ▪ Heating Gain Through Building Structure ▪ Heating Load Due To Infiltration & Ventilation ▪ Heating Gain Due To Occupants ▪ Heat Gain Due To Machines Heat Gain Due To Products	
6	Condensers	▪ Factor Affecting the Condenser Capacity ▪ Classification of Condenser ▪ Cooling Towers ▪ Thermal Calculation of Condensers	
7	Evaporators	▪ Factor Affecting the Evaporator	

No.	Unit Title	Unit Content	Hours
		Capacity ▪ Types of Evaporators ▪ Thermal Calculation of Evaporators	
8	Compressors	▪ Classifications: Reciprocating, Rotary, and centrifugal Compressors ▪ Work Done by Reciprocating Compressors ▪ Volumetric Efficiency of Reciprocating Compressor ▪ Rotary Compressors	
9	Expansion Valves	▪ Centrifugal Compressors ▪ Capillary Tube ▪ Automatic Expansion Valve ▪ Thermostatic Type	
10	Application of Refrigeration	▪ Domestic Refrigerator ▪ Commercial Refrigerator ▪ Ice Marker ▪ Water Cooler ▪ Refrigeration in Trucks& Containers	

Teaching Methods:

1. Lectures
2. Power point presentations
3. Discussion

Books and references:

1. Silberste in Whitman, Heat Pumps and Refrigeration and Air Conditioning Technology, 3rd Edition, ISBN:07668195901401837654

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	020203132
Course Title	Heating systems workshops
Credit Hours	2
Theoretical Hours	0
Practical Hours	6

Short Description:

- Safety rules, Tools ,machinery used for heating system, Practice in heating equipment, use and care of hand and power tools ,piping fabrication of copper, steel, cast iron ,and plastic pipe, oil burner, boiler installation and service

Course Objectives:

At the completion of this Workshop, each student is expected to be able to:

1. Aware of workshop safety rules and tooling.
2. Assembly of radiators in sections and prepare it for installation.
3. Working with different types of pipes.
4. Installing Fixtures, Valves, and Faucets
5. Study the performance of Fuel Gas Systems Module.
6. Calibrate deferent components of the systems

Detailed Description:

No.	Unit Title	Unit Content	Hours
1		▪ Basic Safety ▪ Introduction to Hand Tools ▪ Introduction to Power Tools ▪ Introduction to Blueprints	

No.	Unit Title	Unit Content	Hours
		▪ Cutting and Threading of different metal pipes ▪ Cutting and welding of copper pipes and connecting	
2		▪ Assembly of radiators in sections and prepare it for installation ▪ Installation of central heating systems consist of six radiators and showing the method of connection ▪ Installation of underfloor 2heating system ▪ Pipes thermal insulation Installation f	
3		▪ Complete central heating system 2 Perpetration of boiler foundation, Boiler assembly, accessories installation, heat exchanger, Fuel tank and Chimney	
4		▪ Installation of complete bath room system with cold and hot water lines ▪ Showers, Bedizen, and electrical water heater ▪ Construction of manhole ▪ Burner assembly and disassembly	
5		▪ Burner operation and fuel and air	

No.	Unit Title	Unit Content	Hours
		calibration ▪ Temperature and pressure calibration ▪ Exhaust gas analysis ▪ Introduction to the Plumbing	
6		▪ Plumbing Tools ▪ Plastic Pipe and Fittings ▪ Introduction to Drain, Waste, and Vent(DWV) Systems	
7		▪ Installing and Testing DMV Piping ▪ Installing Roof, Floor, and Area Drains ▪ Types of Valves ▪ Installing and Testing Water Supply Piping ▪ Installing Fixtures, Valves, and Faucets ▪ Fuel Gas Systems Module Servicing of Fixtures, Valves ,and Faucets Installing Water Heaters	

Teaching Methods:

1. Short Lectures
2. Workshop
3. Discussion

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	020203241
Course Title	HVACR Instrumentation and control systems
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Short Description:

Measurement and Pneumatics control, Temperature measurement and control devices, Electrical control devices, Domestic Air conditioner control circuit, Air conditioning and heating control system, Temperature control system, Heating system control system,

Course Objectives:

Upon successful completion of this course, the student should be able to:

1. Understand the basic concepts and components of control loop
2. Draw the block diagram of control system
3. Explain the method of temperature, pressure, flow rate, level and humidity measurements and control
4. Discuss the difference between the various types of control system
5. Understand the function of overload, relays and defrost timer

Detailed Description:

No.	Unit Title	Unit Content	Hours
1	Measurement and Pneumatics control	Testing of Measuring and Pneumatic control devices (Pressure measurements and regulators, Pneumatic relays	
2	Temperature measurement and control devices	Operation and Testing of Temperature measurement and control devices such as different types of thermostat, Different temperature measurement devices	
3	Electrical control devices	Operation and testing of Electrical control devices: electronic controller, amplifiers, electrical motors, automatic cutouts, relays, Fuses, magnetics witches	
4	Domestic Air conditioner control circuit	Control loop elements, Control loop construction Defects diagnostic in the control loop: short circuit, winding cutout, relays contact melting	
5	Heating system control system	Control loop elements, Control loop construction Defects diagnostic in the control	

No.	Unit Title	Unit Content	Hours
		loop	
6	Temperature control system	Control loop elements, Control loop construction, Open and closed loop control systems, Defects diagnostic in the control loop	
7	Air conditioning and heating control system	Control loop elements, Switching between heating and Air conditioning, Manual control, Different types of automatic control systems.	

Teaching Methods:

1. Lectures
2. Power point presentations
3. Discussion

Books and references:

1. John I. Levenhagen, HVAC Control System Design Diagrams, ISBN0207023812921.
2. Christopher Under wood, C.P. Underwood, HVAC Control Systems: Modelling, Analysis, and Design, ISBN0241922098028.
3. John I.L evenhagen, Donald H. and Spethmann, HVAC Controls and Systems, 1st Edition, McGraw2 Hill1993, ISBN0070375097.
4. S. Don Swenson, HVAC Controls and Control Systems, Prentice Hall, 1994, ISBN21020130453609

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	020203242
Course Title	HVACR Instrumentation and control systems Lab.
Credit Hours	1
Theoretical Hours	0
Practical Hours	3

Short Description:

Measuring and control elements, Temperature, pressure, flow rate and humidity measurement and control, Control system of cooling, heating and A/C processes ,Adjustment. Monitoring & troubleshooting

Course Objectives:

Upon successful completion of this course, the student should be able to: 1. Conduct temperature, pressure, humidity and Air-Fuel ratio measurements and control 2. Test pressure regulator and Thermostat 3. Installation and using of overload, relays and defrost timer 4. Test the Solenoid Valve 5. Differentiate between different type of directional valves used in pneumatic control systems

Detailed Description:

No.	Unit Content	Hours
1	Pressure measurements	
2	Pressure regulators	
3	Temperature measurements Thermostat	
4	Flow rate measurement and control humidity measurement and control	
5	Electricalcontrollingelements(Relay,overload,contractor)ExpansionDevice	
6	Temperature and pressure controllers	
7	Three way controllers	
8	Air ventilation and air conditioning control system	
9	Solenoid Valve Controller	

Teaching Methods:

Laboratory

Books and references: lab Sheets

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	٠٢٠٢٠2213
Course Title	Forging and Welding Technology Workshop
Credit Hours	2
Theoretical Hours	0
Practical Hours	6

Short Description:

Vertical and overhead welding positions. Oxy-acetylene welding including joints preparation, wires selection. Electrical arc welding process and applications. Metal inert gas welding. Forging and heat treatment.

Course Objectives:

At the completion of this Workshop, each student is expected to be able to:

1. Take care of safety regulations in the workshop.
2. Differentiate between different types of welding.
3. Differentiate between different types of welding positions.
4. Perform Vertical and overhead welding.

5. Prepare joints for Welding.
6. Perform Welding with Electrical arc, Oxy-acetylene, and Metal inert gas technologies.
7. Selecting welding wires.

Detailed Description:

No.	Unit Content	Hours
1	Safety in Welding and Forging Workshop	12
2	Electrical arc welding	12
3	Study and perform Vertical and overhead welding positions.	6
4	Wires selection	6
5	Use Oxy-acetylene welding and joints preparation.	12
6	Metal inert gas welding.	12
7	Material properties, standard size, selection and identification	6
8	Forging and heat treatments.	12

Teaching Methods:

Short lectures

Workshop Material

Books and references:

Workshop-Sheets

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	٠٢٠٢٠٣٢٣٤
Course Title	Air conditioning system workshop
Credit Hours	2
Theoretical Hours	0
Practical Hours	6

Short Description:

The objective of the Air Conditioning workshop Course is to train and prepare the students for entry level positions as service and maintenance technicians in the field of air conditioning and refrigeration. Upon successful completion of the course the individual should have the necessary skills to enter the field of refrigeration and air conditioning. This training course is intended for people who want to improve their knowledge and skills in refrigeration engineering.

Course Objectives:

At the end of this course, the student will:

- Understand the fundamentals of refrigeration and thermodynamics
- Understand how to read P-H diagrams and to size and select air condition units for various applications.
- Identify and understand the functions of air conditioning components
- Understand the safety requirements during installation and servicing of air conditioning systems and be able to troubleshoot and carryout maintenance of the air condition system.
- Understand and apply the safe handling of refrigerants and its uses
- Understand and apply the appreciate cleanliness after service

Detailed Description:

No.	Unit Title	Unit Content	Hours
	GENERAL WORKSHOP PRACTICE	Safety precautions • First Aid • Electric shock • Burns • Workshop arrangement and cleanliness	3
1	**BASIC TOOLS FOR AIR CONDITIONING**	Identification, use, and care of basic and specialized hand tools used in the trade	3
2	AIR CONDITIONING, REFRIGERATION, AND HEATING	Identification, care, and use of different types of instruments required to record temperature, pressure, and heat in various units of	6

	MEASUREMENTS	measurement as used in the air conditioning, refrigeration, and heating trades. Refrigeration cooling loads, heat load and heat gain loads are also taught.	
3	DUCTWORK APPLICATION	Construction of air ducts, including design calculation. Duct coding and standard symbols/notation Sizing and placement of ductwork, registers, and grills for proper air distribution	6
4	RECOVERY, RECYCLING, AND RECLAIMING	In all hands-on projects, students are instructed in the proper procedures required to recover CFCs. Department of Transportation regulations regarding the transport of refrigerant drums and cylinders are reviewed and discussed.	6
5	**A/C testing**	• Testing of refrigeration equipment, • Testing of air-conditioning equipment	6
6	**A/C troubleshooting**	Leak Detection methods • Trouble shooting – flushing and clearing of blockages.	6
7		Charging (over- and under- charging) effects of both and other service procedures for refrigeration and air-conditioning systems	6

Teaching Methods:

The course will be conducted with formal lectures and interactive worked examples included. Presented also will be several illustrative and instructive videos. The emphasis in the course will be on the explanation of all technical points. Each learning point will be reinforced with practical

examples.

Books and references:

- Principles of Refrigeration by C. Thomas Oliver
- Ref and Air-conditioning Tech. (MOTIVATE.) By N. Cook
- Fundamentals of Refrigeration & Air-conditioning by Billy Langley
- Refrigeration and Air-conditioning Technology: by William C. Whitman
- Tropical Refrigeration & Airconditioning by L.W. Cottel and S. Olarewaju

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	٠٢٠٢٠٣١٢١
Course Title	Sanitary Engineering
Credit Hours	2
Theoretical Hours	2
Practical Hours	0

Short Description:

Sanitary engineering systems are important aspects of the building design. This course presents criteria pertinent to the design of drainage (sanitary and storm), water, and fuel gases. Energy conservation requirements are also discussed.

Course Objectives:

At the end of this course, the student will:

- Have a better understanding of the design criteria for sanitary systems; and
- Be familiar with various energy conservation methods.

Detailed Description:

No.	Unit Title	Unit Content	Hours
1	**PLUMBING CRITERIA**	1. SCOPE 2. CANCELLATION 3. RELATED CRITERIA 4. POLICY a. Economy b. Reliability c. Material and Construction d. Protection of Computers and Other Equipment from Water Damage	3
2	**DRAINAGE SYSTEMS**	1. SANITARY SYSTEM a. Sumps and Sump Pumps b. Interceptors c. Chemical Wastes d. Backwater Valves e. Food Waste Grinders f. Floor Drains 2. STORM DRAINAGE SYSTEM a. General b. Downspouts c. Sub-Soil Drains d. Piping System 3. COMBINED SANITARY AND STORM DRAINAGE SYSTEM a. System Layout	6

No.	Unit Title	Unit Content	Hours
		b. Backflow c. P-Traps in Storm Drainage Systems	
3	**WATER SUPPLY SYSTEMS**	. 1. PIPING SYSTEMS a. Water Service b. Water Hammer Arrestors 2. BOOSTER SYSTEMS AND PUMPS a. Hydro-Pneumatic System b. Booster Pumps 3. HOT WATER SYSTEMS a. Water Temperatures b. Water Heaters c. Hot Water Circulation 4. CHILLED DRINKING WATER SYSTEMS a. Types of Units b. Design	12
4	**INSULATION OF PLUMBING SYSTEMS**	1. HOT WATER SYSTEMS a. Unfired Water Storage b. Electric Water Heaters c. Gas and Oil Fired Water Heaters d. Recirculated Systems e. Insulation 2. MISCELLANEOUS SYSTEMS a. Cold Water b. Heating System c. Rainwater Conductors	6

No.	Unit Title	Unit Content	Hours
		d. Freezing Temperatures e. Design	
5	**FUEL GAS SYSTEMS**	1. DESIGN 2. SAFETY PRECAUTIONS a. System Pressure b. Pressure Regulator Location c. Seismic Consideration d. Ventilation	6
6	**ENERGY CONSERVATION**	1. AIR SOURCE HEAT PUMPS a. General b. Packaged Water Heater Heat Pump c. Sizing d. Retrofit e. Geographic Influence f. Equipment Location g. Exhaust Air 2. WATER SOURCE HEAT PUMPS a. Condenser Water Source b. Exhaust Air to Water c. Process Fluid d. Groundwater e. Buried Pipe f. Storage Tanks and Standpipes g. Solar Thermal Storage 3. HEAT RECOVERY AIR CONDITIONING SYSTEMS	9

No.	Unit Title	Unit Content	Hours
		a. Auxiliary Condensers b. Desuperheater 4. HEAT RECOVERY FROM REFRIGERATION a. Auxiliary Heat Exchanger b. Water Loop 5. SOLAR DOMESTIC HOT WATER a. System Types b. Applications c. Performance d. Economics e. Design Criteria 6. WATER-TO-WATER RECOVERY 7. POINT-OF-USE HEATERS a. Booster Heaters b. Line Heaters c. Modular Boilers 8. TOTAL ENERGY RECOVERY a. Cogeneration b. Stand-Alone System 9. POWER BURNERS a. Water Heaters b. Tankless Heaters 10. FLOW CONTROL a. In-Line Flow Regulators b. Automatic Valves	

No.	Unit Title	Unit Content	Hours
		11. COST OF ENERGY a. Evaluation b. Example c. Metering d. Control 12. RATINGS AND WARRANTIES a. Capacity b. Special Problem	

Teaching Methods:

The course will be conducted with formal lectures and interactive worked examples included. Presented also will be several illustrative and instructive videos. The emphasis in the course will be on the explanation of all technical points. Each learning point will be reinforced with practical examples.

Books and references:

- Charanjeet S. Shah; Water Supply and Sanitation; Galgotia Publication 2015
- S.C.Rangwala,Water Supply and Sanitary Engineering (Environmental Engineering), 26th edition, 2012 , ISBN : 9789380358666
- S.K. Husian, Textbook of Water Supply and Sanitary Engineering (3/e) 2006

Associate Degree Program

Specialization	Air conditioning and refrigeration
Course Number	٠٢٠٢٠٣١٢٢
Course Title	Sanitary Engineering workshop
Credit Hours	2
Theoretical Hours	0
Practical Hours	6

Short Description:

Sanitary engineering systems are important aspects of the building design. This course presents criteria pertinent to the design of drainage (sanitary and storm), water, and fuel gases. Energy conservation requirements are also discussed.

Course Objectives:

At the end of this course, the student will:

- Have a better understanding of the design criteria for sanitary systems; and
- Be familiar with various energy conservation methods.

Detailed Description:

No.	Unit Title	Unit Content	Hours
1	**Introduction to tools and equipment's**	1. Hand Tools 2. Stocks and Dies 3. Pipe and Bench Vice 4. Bending Machines	3
2	**Pipes Testing**	1. Pressure Test 2. Water Test 3. Smoke Test 4. Ball Test	6
3	**Safety**	.1. Health and safety 2. Eye, Hand and foot protection 3. Lifting and carrying	12

No.	Unit Title	Unit Content	Hours
		4. Working on height 5. Electricity	
4	**INSULATION OF PLUMBING SYSTEMS**	1. HOT WATER SYSTEMS a. Unfired Water Storage b. Electric Water Heaters c. Gas and Oil Fired Water Heaters d. Recirculated Systems e. Insulation 2. MISCELLANEOUS SYSTEMS a. Cold Water b. Heating System c. Rainwater Conductors d. Freezing Temperatures e. Design	6
5	**FUEL GAS SYSTEMS**	1. DESIGN 2. SAFETY PRECAUTIONS a. System Pressure b. Pressure Regulator Location c. Seismic Consideration d. Ventilation	6
6	**ENERGY CONSERVATION**	1. AIR SOURCE HEAT PUMPS a. General b. Packaged Water Heater Heat Pump c. Sizing d. Retrofit e. Geographic Influence	9

No.	Unit Title	Unit Content	Hours
		f. Equipment Location g. Exhaust Air 2. WATER SOURCE HEAT PUMPS a. Condenser Water Source b. Exhaust Air to Water c. Process Fluid d. Groundwater e. Buried Pipe f. Storage Tanks and Standpipes g. Solar Thermal Storage 3. HEAT RECOVERY AIR CONDITIONING SYSTEMS a. Auxiliary Condensers b. Desuperheater 4. HEAT RECOVERY FROM REFRIGERATION a. Auxiliary Heat Exchanger b. Water Loop 5. SOLAR DOMESTIC HOT WATER a. System Types b. Applications c. Performance d. Economics e. Design Criteria 6. WATER-TO-WATER RECOVERY 7. POINT-OF-USE HEATERS	

No.	Unit Title	Unit Content	Hours
		a. Booster Heaters b. Line Heaters c. Modular Boilers 8. TOTAL ENERGY RECOVERY a. Cogeneration b. Stand-Alone System 9. POWER BURNERS a. Water Heaters b. Tankless Heaters 10. FLOW CONTROL a. In-Line Flow Regulators b. Automatic Valves 11. COST OF ENERGY a. Evaluation b. Example c. Metering d. Control 12. RATINGS AND WARRANTIES a. Capacity b. Special Problem	

Teaching Methods:

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