MET 412: HVAC & Refrigeration Technology

(Elective)

MET 412: HVAC & Refrigeration Technology. LT: 3 LB: 3 CR: 4

Course Description: This course explores the fundamentals of refrigeration, heating, ventilating and air-conditioning (HVAC) systems theoretically and practically. The course will discuss refrigeration principles, vapor compression cycle, refrigeration systems, the conditions for a comfortable and healthy indoor environment, such as physiological considerations, environmental indices, and control of indoor air quality.

The course will introduce the analysis of air-conditioning/psychrometric processes, and then discuss the estimation of energy to be added to (heating load) or extracted from (cooling load) a space. The course will also discuss different HVAC system components such as air handling units, water chillers, hot water boilers, cooling towers, evaporative condensers, fans and pumps, …etc., including the water distribution system, duct design and air distribution method as well as laboratory activities.

Prerequisite: MET 303 – Applied Thermodynamics and Heat Transfer
MET 306 – Applied Fluid Mechanics

Textbooks:

1. F.C. McQuiston, J.D. Parker, and J.D. Spitler, Heating, Ventilating, and Air Conditioning: Analysis and Design, 6th Edition, Wiley, New York, 2005.
2. MET 412**:** HVAC & Refrigeration Technology Laboratory Manual.

References:

1. ASHRAE Handbook of Fundamentals, 2005 Edition, Atlanta, GA
2. R.H. Howell, H. J. Sauer, and W.J. Coad, "Principles of Heating Ventilating and Air Conditioning", ASHRAE, Atlanta, GA, 1998.

Course Learning Objectives: To enable the students to:

1. Explain the performance of a simple refrigeration and multi-pressure systems
2. Identify the classical moist air processes.
3. Identify the field of application of air conditioning systems and describe the components of different air conditioning systems.
4. Choose the appropriate A/C systems.
5. Select air supply and return devices using tables.
6. Select piping materials, connections and fittings for chilled or hot water system.
7. Calculate pressure loss in duct and fittings, fan power and size of a simple branched duct system.
8. Calculate cooling loads using load calculation programs, select AC components using Courses and software's.

Course Outline:
[I] Modules:

Module	Topic	Duration
1.	Principles of refrigeration	1 Week
2.	Refrigeration systems and equipment	2 Weeks
3.	Properties of Moist Air and Conditioning Processes	2 Weeks
4.	Air Conditioning systems and equipment	2Weeks
5.	Space Heat Load	1 Week
6.	The cooling Load	2 Weeks
7.	Fluid Flow, Pumps, and Piping Design	2 Weeks
8.	Air Distribution system	1 Week
9.	Fans and Building Air Distribution	2 Weeks

[II] Laboratory Work/Projects:

Exercise	Topic	Duration
1.	Safety in refrigeration and air conditioning workshop.	1 week
2.	Components and functions of refrigeration system.	1 week
3.	Basic refrigeration cycle.	1 week
4.	Reverse Cycle Refrigeration Training System.	1 week
5.	Industrial refrigeration trainer.	1 week
6.	Components and function of A/C system.	1 week
7.	Sensible heating and cooling	1 week
8.	Cooling and dehumidifying of moist air	1 week
9.	Heating and humidifying of moist air	1 week
10.	Industrial refrigeration faults simulation	1 week
11.	Piping design calculation.	1 week
12.	Duct design calculation	1 week
13.	Equipment selection.	1 week
	Revision	1 week

Evaluation Methods:

1. Assignments and Quizzes (10%)
2. Majors theory Exams (20%)
3. Final theory Exam (35%)
4. Lab work, mid and final Lab Exam (35%)

Course Learning Outcomes:

The expected learning outcome is that the students will be able to:

1. Explain the performance of a simple refrigeration and multi-pressure systems
2. Determine the appropriate cycle for a given climatic conditions and represent it on the psychrometric chart.
3. Identify equipment for cooling and dehumidifying indoor air.
4. Evaluate performance of cooling and dehumidifying equipment.
5. Identify equipment and evaluate performance of heating and dehumidifying process
6. Choose the appropriate A/C systems.
7. Select the appropriate refrigeration and A/C equipments.
8. Select air supply and return devices using tables.
9. Calculate pressure loss in duct and fittings, fan power and size of a simple branched duct system.
10. Determine ventilation rates for different applications.
11. Select piping materials, connections and fittings for chilled or hot water system.
12. Calculate pressure drop in a piping network, pump head, and the size of a simple piping system.
13. Calculate cooling loads using load calculation programs, select AC components using Courses and software's.

Prepared by:

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