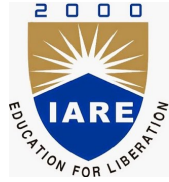


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Question Paper Code: AME017



INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B.Tech VII Semester End Examinations, November 2020

Regulations: IARE - R16

REFRIGERATION AND AIR CONDITIONING MECHANICAL ENGINEERING

Time: 3 hour

Maximum Marks: 70

Answer ONE Question from each MODULE

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

MODULE-I

- (a) What are the important types of vapour compression cycles? Explain with the help of P-h diagram. [7m]

(b) The capacity of a refrigerator is 200 TR when working between $-6^{\circ}C$ and $25^{\circ}C$. Determine the mass of ice produced per day from water at $25^{\circ}C$. Also find the power required to drive the unit. Assume that the cycle operates on reversed Carnot cycle and latent heat of ice is $335KJ/Kg$. [7m]
- (a) Distinguish between dry and wet compression. What are the advantages of one over the other? [7m]

(b) During flight, it was observed that rudder got fixed 3 degree right. Explain, how the pilot will handle this condition? Show with diagram. A refrigerator using CO_2 as refrigerant works between the temperatures $17.5^{\circ}C$ and $-17.5^{\circ}C$. The CO_2 leaves the compressor at $30^{\circ}C$. The gas is completely condensed but there is no under cooling. Calculate theoretical COP. [7m]

MODULE-II

- (a) Explain with neat sketch Domestic Electrolux Refrigerator, with the functions of hydrogen, ammonia and water in the three fluid refrigeration system. [7m]

(b) Calculate the COP of vapour absorption refrigeration system has the generator temperature of $80^{\circ}C$, condenser temperature of $25^{\circ}C$ and an evaporator temperature of $-10^{\circ}C$. [7m]
- (a) Explain the function of liquid-vapour heat exchanger between the generator and absorber and how it can improve the performance of the vapour absorption system. [7m]

(b) Explain the working of a practical Ammonia-water vapour absorption refrigeration system with neat sketch. [7m]

MODULE-III

5. (a) Illustrate the working principle and operation of a steam jet refrigeration system with the help of a neat sketch. [7m]
(b) What are natural refrigerants? Explain the potential of alternative refrigerants such as HFCs and HCFCs. [7m]
6. (a) Describe the working principle of bare tube coil, finned tube coil and plate type evaporators with neat sketches. [7m]
(b) Explain the working of natural convection and forced convection type evaporator, also discuss their merits and demerits. [7m]

MODULE-IV

7. (a) Represent the following process in a skeleton psychometric chart. [7m]
(i) Sensible cooling
(ii) Cooling and humidification
(iii) Adiabatic mixing of air streams.
(b) The sensible heat factor of an air-conditioned room is 0.67. The condition of the air leaving the air-conditioned room is 27°C DBT and 52% RH. The maximum permissible temperature difference between the inlet air and outlet air is 11°C . If the quantity of air flow at the inlet of the room is $180\text{m}^3/\text{min}$, then determine the sensible and latent heat load of air conditioned room. [7m]
8. (a) Write any two major requirements of human comfort. Also sketch the process of heating and dehumidification on psychometric chart. [7m]
(b) The atmospheric air at 18°C DBT and 70% RH is supplied to the heating chamber at the rate of $120\text{m}^3/\text{min}$. The leaving air has a temperature of 24°C without change in its moisture contents. Determine the heat added to the air per minute and final RH of the air. [7m]

MODULE-V

9. (a) Discuss about the performance of Heat pump when used with the different sources of heat. State the advantages and disadvantages in each case. [7m]
(b) Describe any two methods of humidification of air by atomizing the water into air, with simple line sketches. [7m]
10. (a) Explain the following heat pump circuits with a neat sketch fixed refrigerant circuit design. [7m]
(b) Describe the working of the heat pump by drawing the circuit for air to water design. [7m]

****END OF EXAMINATION****

COURSE OBJECTIVES:

The course should enable the students to:

1	The principles of thermodynamics in refrigeration and air conditioning, analyze the methods of refrigeration, recognize the necessity and ideal cycle of refrigeration.
2	The nomenclature of refrigerants, realize the desirable properties of refrigerants to probe their ozone depleting and global warming potential.
3	The working principles, limitations, maintenance of refrigeration and air conditioning equipment and study their impact on the performance of the system.
4	The psychrometric relations, processes, utilize their principles to resolve cooling load calculations and design of air conditioning systems.

COURSE OUTCOMES:

After successful completion of the course, students should be able to:

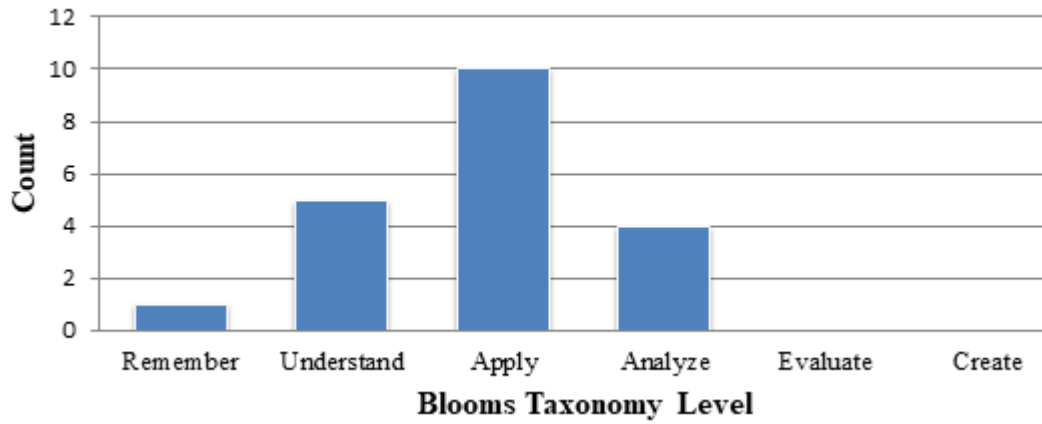
CO 1	Relate the performance of a vapour compression refrigeration cycles under specified inlet and outlet conditions.
CO 2	Identify the modifications required in an impossible reversed Carnot cycle to convert it into practical cycle for refrigeration applications.
CO 3	Demonstrate the working principle and coefficient of performance of a heat pump, heat engine and refrigerator.
CO 4	Illustrate the working principles, limitations of practical aqua ammonia, LiBr-Water and Electrolux vapour absorption refrigeration systems.
CO 5	Analyze theoretical, practical aircraft refrigeration and steam jet refrigeration cycles with T-S diagrams, by stating merits, limitations, etc.
CO 6	Discuss the measures to protect the ozone layer through global control, eventually elimination of production and utilization of ozone depleting substances.
CO 7	Classify the equipment used for the refrigeration, air conditioning purposes with suitable materials and refrigerant pairs.
CO 8	Construct the sensible heat factor lines, locate alignment circle and SHF scale on a psychrometric chart for the cooling load calculations of air conditioning systems.
CO 9	Explain thermal comfort conditions with respect to effective temperature, relative humidity, etc. and their impact on human comfort, productivity and health.
CO 10	Distinguish the equipment required for air conditioning systems, study the operating principles, safety controls employed in air conditioning systems.
CO 11	Apply the principles of psychrometry to calculate and design the air conditioning systems for particular purpose.
CO 12	Compare the various heat pump circuits for heating, cooling purposes with suitable industrial applications.

MAPPING OF SEMESTER END EXAMINATION QUESTIONS TO COURSE OUTCOMES

Q.No		All Questions carry equal marks	Taxonomy	CO's	PO's
1	a	What are the important types of vapour compression cycles? Explain with the help of P-h diagram.	Apply	CO 1	PO 1
	b	The capacity of a refrigerator is 200 TR when working between $-6^{\circ}C$ and $25^{\circ}C$. Determine the mass of ice produced per day from water at $25^{\circ}C$. Also find the power required to drive the unit. Assume that the cycle operates on reversed Carnot cycle and latent heat of ice is $335KJ/Kg$.	Apply	CO 2	PO 2
2	a	Distinguish between dry and wet compression. What are the advantages of one over the other?	Analyze	CO 1	PO 1
	b	During flight, it was observed that rudder got fixed 3 degree right. Explain, how the pilot will handle this condition? Show with diagram. A refrigerator using CO_2 as refrigerant works between the temperatures $17.50^{\circ}C$ and $-17.5^{\circ}C$. The CO_2 leaves the compressor at $30^{\circ}C$. The gas is completely condensed but there is no under cooling. Calculate theoretical COP.	Apply	CO 3	PO 2
3	a	Explain with neat sketch Domestic Electrolux Refrigerator, with the functions of hydrogen, ammonia and water in the three fluid refrigeration system.	Understand	CO 4	PO 4
	b	Calculate the COP of vapour absorption refrigeration system has the generator temperature of $80^{\circ}C$, condenser temperature of $25^{\circ}C$ and an evaporator temperature of $-10^{\circ}C$.	Apply	CO 4	PO 4
4	a	Explain the function of liquid-vapour heat exchanger between the generator and absorber and how it can improve the performance of the vapour absorption system.	Apply	CO 4	PO 4
	b	Explain the working of a practical Ammonia-water vapour absorption refrigeration system with neat sketch.	Apply	CO 4	PO 4
5	a	Illustrate the working principle and operation of a steam jet refrigeration system with the help of a neat sketch.	Analyze	CO 5	PO 4

	b	What are natural refrigerants? Explain the potential of alternative refrigerants such as HFCs and HCFCs.	Analyze	CO 6	PO 4
6	a	Describe the working principle of bare tube coil, finned tube coil and plate type evaporators with neat sketches.	Understand	CO 7	PO 1
	b	Explain the working of natural convection and forced convection type evaporator, also discuss their merits and demerits.	Apply	CO 7	PO 1
7	a	Represent the following process in a skeleton psychometric chart. (i) Sensible cooling (ii) Cooling and humidification (iii) Adiabatic mixing of air streams.	Understand	CO 7	PO 1
	b	The sensible heat factor of an air-conditioned room is 0.67. The condition of the air leaving the air-conditioned room is 27°C DBT and 52% RH. The maximum permissible temperature difference between the inlet air and outlet air is 11°C . If the quantity of air flow at the inlet of the room is $180\text{m}^3/\text{min}$, then determine the sensible and latent heat load of air conditioned room.	Apply	CO 7	PO 1
8	a	Write any two major requirements of human comfort. Also sketch the process of heating and dehumidification on psychometric chart.	Apply	CO 8	PO 1
	b	The atmospheric air at 18°C DBT and 70% RH is supplied to the heating chamber at the rate of $120\text{m}^3/\text{min}$. The leaving air has a temperature of 24°C without change in its moisture contents. Determine the heat added to the air per minute and final RH of the air.	Apply	CO 8	PO 4
9	a	Discuss about the performance of Heat pump when used with the different sources of heat. State the advantages and disadvantages in each case.	Understand	CO 10	PO 1
	b	Describe any two methods of humidification of air by atomizing the water into air, with simple line sketches.	Understand	CO 10	PO 1
10	a	Explain the following heat pump circuits with a neat sketch fixed refrigerant circuit design.	Understand	CO 12	PO 4
	b	Describe the working of the heat pump by drawing the circuit for air to water design.	Analyze	CO 10	PO 1,2

KNOWLEDGE COMPETENCY LEVELS OF MODEL QUESTION PAPER



Signature of Course Coordinator
Mr. A Somaiah, Assistant Professor

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