BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of RAC Skills

Session: 2021-22 (Summer Semester)

B. Voc. 5th Semester

2nd In Sem. Examination

Course Code: HVA1501 **Time: 1 Hours**

Course Name: Heat Load Estimation **Max. Marks: 20**

Instruction: Attempt all questions

Section – A

05X01 = 05 Marks

1. Ventilation rate can be calculated using:-
   a) People Outdoor Air b) ACPH c) Outdoor Air per area d) All of the above

2. Resistance of a material depends on:-
   a) Thickness and thermal conductivity
   b) Thickness and thermal resistance
   c) Specific heat and Area
   d) Specific Volume and thickness

3. Which of the following is done after zoning?
   a) Spacing
   b) Floor and Ceiling levels
   c) Load Calculations
   d) Room Bounding

4. Dependence on the wavelength is referred to as:
   a) Durability
   b) Spectral
   c) Specular
   d) Diffuse surface

5. The transport of energy in a fluid or gas by mixing in addition to conduction is called:
   a) Convection
   b) Radiation
   c) Insulation
   d) Evaporation

Section – B

03X02 = 06 Marks

1. What is the relationship between R-value and U value?
2. What is effective leakage area method?
3. How is convection heat transfer is calculated?

Section – C

03X03 = 09 Marks

1. A 0.6 m thick uninsulated wall with an area of 16 m^2 is made out of concrete with a conductivity of 1.25 W/(m·K). What is the R-value of the wall? Under steady-state conditions, with the exterior surface temperature of the wall at 15°C and the interior surface temperature of the wall at 35°C, what is the total heat loss through the wall?

2. What are the properties of radiation?

3. A window with a surface area of 25 m^2 is heated by the sun to a temperature of 55°C at a time when the outdoor air is at 23°C, and a light breeze results in a convection coefficient of 42 $W/(m^2 \cdot K)$. What is the heat lost by the surface due to convection?

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Course Name: Heat Load Estimation **Max. Marks: 20**

Instruction: Attempt all questions

Section – A

05X01 = 05 Marks

1. D
2. A
3. c
4. B
5. A

Section – B

03X02 = 06 Marks

1. R is the resistance and U is conductance.

2. The method to determine the rate of air infiltration is based on the effective leakage area of various construction components used in both residential and commercial buildings.

To obtain the building's total leakage area, multiply the overall dimensions or number of occurrences of each building component by the Leakage related to them.

3. Thermal convection is the transport of energy in a fluid or gas by mixing in addition to conduction. For load calculations, we are primarily interested in convection between an envelope surface (e.g., wall, roof) and the indoor or outdoor air. The rate of convection heat transfer depends on the temperature difference, whether the flow is laminar or turbulent, and whether it is buoyancy driven or driven b.y an external flow.

Section – C

03X03 = 09 Marks

1. The concrete wall of from is improved by adding a 0.05 m thick layer of expanded polystyrene, with an R-value of 1.76, and a layer of 0.013 m

1.76+0.08+0.09= 1.93

R combined = 1.93

Q= (10 x 15)/1.93 = 77 W

77 W x 3.41 = 262 BTU

2. Properties of interest include the following:

- Absorptance, ά the ratio of radiation absorbed by a surface to that incident on the surface.
- Emittance,ε , the ratio of radiation emitted by a surface to that emitted by an ideal "black" surface at the same temperature
- Reflectance, ρ, the ratio of radiation reflected by a surface to that incident on the surface
- Transmittance, τ, the ratio of radiation transmitted by a translucent surface to that incident on the surface

3 **The convection heat transfer rate is usually expressed:**

$$q = hA(t-ts)$$

- **where h = convection coefficient, W/(m2·K) t = bulk temperature of the air, °C ts = surface temperature, °C**

5.68×10^{-8} $(280^4 - 272^4)$ = 6146560000-5473632256

=672927744

6.7×10^8

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of RAC Skills

V Semester, 2nd In-Sem. Examination

B. Voc. Program, Summer Semester (2021-22)

Course Code: HVA1502 Time: 1 Hour

Course Name: Cold Chain & Cold Storage Max. Marks: 20

Instruction:

1. Attempt all Questions.
2. Psychrometry chart is allowed.
3. Each question of Section – A carries 01 mark.
4. Each question of Section – B carries 02 mark.
5. Each question of Section – C carries 03 mark.

Section – A

05X01 = 05 Marks

1. What is the unit of specific volume?
   a. Kg/m^3
   b. m^3/Kg
   c. Kj/Kg
   d. None of the above
2. Which of the following is the most precise one?
   a. Capillary tube
   b. TEV
   c. EEV
   d. None of the above
3. Convert 2.5 Kw-h into KJ.
   a. 3600
   b. 9000
   c. 5000
   d. None of the above
4. What is the measuring unit of specific heat?
   a. KJ/KgK
   b. KJ/Kg
   c. KJ/S
   d. None of the above
5. Convert 35 Kw into hp.
   a. 1.125
   b. 112.5
   c. 11.25
   d. None of the above

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Section – B

03X02 = 06 Marks

1. A cold room with dimensions 10mx8mx5m. Outside and inside temperatures are 35°C and 4°C, while the floor temperature is 6°C. Overall heat transfer coefficient is 0.41 w/sqm°C. If the plant operates for 15 hours daily, find out total transmission load.
2. A cold room of size 20mx15mx8m. Outside and inside temperatures are 30°C and 6°C, while the floor temperature is 8°C. Overall heat transfer coefficient is 0.37 w/sqm°C. 5000 Kgs of apple are to be stored and 4 people work daily for four hours inside the cold storage and each person generates heat of 270 W. find out the sum of occupancy and product load. (use specific heat of apple 2.2 kJ kg^{-1} $°C^{-1}$).
3. A cold storage of dimension 25mx12mx5m. Outside and inside temperatures are 35°C and 8°C, while the floor temperature is 8°C. Overall heat transfer coefficient is 0.35 w/sqm°C. 2000 Kgs of apple are to be stored and 4 people work daily for four hours inside the cold storage and each person generates heat of 270 W. Specific heat of apple is 2.2 kJ kg^{-1} $°C^{-1}$. Enthalpy at 30°C DBT and 18.5°C WBT is 63 KJ/Kg of da. Enthalpy at 6°C and 90% RH is 20 KJ/Kg of da. 4 fans are used of motor capacity 120 W each and run for 10 hours. 4 Lamps are used of capacity 100 W each and run for 5 hours. If the plant operates for 18 hours daily, find out infiltration and occupancy load of storage (Consider 2 ACPH and respiration rate of product is 9.1 KJ/Kg/day).

Section – C

03X03 = 09 Marks

1. Following data given for a cold room:
   Store Dimensions: 15mX10mX5m. Over all U Value - 0.35 w/sqm°C. Outside Design Conditions: 35°C DBT, 20°C WBT (Enthalpy = 66 KJ/Kg), Inside Design Conditions: 4°C+/-1°C, 75%RH (Enthalpy = 13 KJ/Kg). Product: Daily 2500Kg/24 hrs coming at 35°C with specific heat 3.0 KJ/Kg°C and 2APCH. Consider 4 men working for 4 hours daily. 4 fans are used of motor capacity 150 W each and run for 10 hours. 4 Lamps are used of capacity 50 W each and run for 5 hours. Each cubic meter of new air provides 2KJ/cm°C. Find out total load.
2. A cold storage of dimension 10mx5mx3m. Outside and inside temperatures are 30°C and 6°C, while the floor temperature is 8°C. Overall heat transfer coefficient is 0.37 w/sqm°C. 2500 Kgs of apple are to be stored and 4 people work daily for four hours inside the cold storage and each person generates heat of 270 W. Specific heat of apple is 2.2 kJ kg^{-1} $°C^{-1}$. Enthalpy at 30°C DBT and 18.5°C WBT is 63 KJ/Kg of da. Enthalpy at 6°C and 90% RH is 20 KJ/Kg of da. 4 fans are used of motor capacity 120 W each and run for 10 hours. 4 Lamps are used of capacity 100 W each and run for 5 hours. If the plant operates for 18 hours daily, find out total load of storage (Consider 2 ACPH and respiration rate of product is 9.1 KJ/Kg/day).
3. Store Dimensions: 10mX6mX3m. Over all U Value - 0.24 w/sqm°C. Outside Design Conditions: 40°C DBT, 25°C WBT (Enthalpy = 94 KJ/Kg), Inside Design Conditions: 4°C+/-1°C, 75%RH (Enthalpy = 13 KJ/Kg). Product: Daily 3000Kg/24 hrs coming at 30°C. Consider 2 men working for 4 hours daily. 4 fans are used of motor capacity 120 W each and run for 10 hours. 4 Lamps are used of capacity 100 W each and run for 5 hours. Consider specific heat of product is 2.5 KJ/Kg°C and 2 ACPH. Find out total load.

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of RAC Skills

V Semester, 2nd In-Sem. Examination

B. Voc. Program, Summer Semester (2021-22)

Time: 1 Hour

Course Code: HVA1502

Max. Marks: 20

Course Name: Cold Chain & Cold Storage

Instruction:

1. Attempt all Questions.
2. Psychrometry chart is allowed.
3. Each question of Section – A carries 01 mark.
4. Each question of Section – B carries 02 mark.
5. Each question of Section – C carries 03 mark.

Section – A

05X01 = 05 Marks

1. What is the unit of specific volume?
   b. m^3/Kg
2. Which of the following is the most precise one?
   c. EEV
3. Convert 2.5 Kw-h into KJ.
   b. 9000
4. What is the measuring unit of specific heat?
   a. KJ/KgK
5. Convert 35 Kw into hp.
   c. 11.25

Section – B

03X02 = 06 Marks

1. A cold room with dimensions 10mx8mx5m. Outside and inside temperatures are 35°C and 4°C, while the floor temperature is 6°C. Overall heat transfer coefficient is 0.41 w/sqm°C. If the plant operates for 15 hours daily, find out total transmission load.

Answer: Transmission Load

Q = U*A*(Outside Temperature – Inside Temperature)*24/1000

= 0.41*260(35-4) *24/1000

= 79.3 Kwh/Day

For floor,

0.41*80(35-6) *24/1000

= 22.8 Kwh/Day

total transmission load = 79.3+22.8 = 122.1 Kwh/Day

for 15 hours operation = 122.1 *15/24 = 76.3 Kw ans.

2. A cold room of size 20mx15mx8m. Outside and inside temperatures are 30°C and 6°C, while the floor temperature is 8°C. Overall heat transfer coefficient is 0.37 w/sqm°C. 5000 Kgs of apple are to be stored and 4 people work daily for four hours inside the cold storage and each person generates heat of 270 W. find out the sum of occupancy and product load. (use specific heat of apple 2.2 kJ $kg^{-1}°C^{-1}$).
   Answer: Product Load
   Q = M*C_P*(Outside Temperature – Inside Temperature)/(3600)
   = 73.3 Kwh/Day
   Occupancy Load
   Q = persons* Time* Heat/1000
   = 4.3 Kwh/Day
   Total Load = 77.6 Kwh/Day ans.
3. A cold storage of dimension 25mx12mx5m. Outside and inside temperatures are 35°C and 8°C, while the floor temperature is 8°C. Overall heat transfer coefficient is 0.35 w/sqm°C. 2000 Kgs of apple are to be stored and 4 people work daily for four hours inside the cold storage and each person generates heat of 270 W. Specific heat of apple is 2.2 kJ $kg^{-1}°C^{-1}$. Enthalpy at 30°C DBT and 18.5°C WBT is 63 KJ/Kg of da. Enthalpy at 6°C and 90% RH is 20 KJ/Kg of da. 4 fans are used of motor capacity 120 W each and run for 10 hours. 4 Lamps are used of capacity 100 W each and run for 5 hours. If the plant operates for 18 hours daily, find out infiltration and occupancy load of storage (Consider 2 ACPH and respiration rate of product is 9.1 KJ/Kg/day).

Answer:

1. Occupancy Load

Q = persons* Time* Heat/1000

= 4.3 Kwh/day

2. Infiltration Load

Q = Changes* Energy* Volume*(Outside Temperature – Inside Temperature)/3600

= 27 Kwh/day

Section – C

03X03 = 09 Marks

1. Following data given for a cold room:
   Store Dimensions: 15mX10mX5m. Over all U Value - 0.35 w/sqm°C. Outside Design Conditions: 35°C DBT, 20°C WBT (Enthalpy = 66 KJ/Kg), Inside Design Conditions: 4°C+/-1°C, 75%RH (Enthalpy = 13 KJ/Kg). Product: Daily 2500Kg/24 hrs coming at 35°C with specific heat 3.0 KJ/Kg°C and 2APCH. Consider 4 men working for 4 hours daily. 4 fans are used of motor capacity 150 W each and run for 10 hours. 4 Lamps are used of capacity 50 W each and run for 5 hours. Each cubic meter of new air provides 2KJ/cm°C. Find out total load.

1. Transmission Load

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Q = U*A*(Outside Temperature – Inside Temperature) *24/1000

= 138.6 Kwh/day

2.Product Load

Q = M*C_P*(Outside Temperature – Inside Temperature)/(3600)

= 62.5 Kwh/day

3. Occupancy Load

Q = persons* Time* Heat/1000

= 4 Kwh/day

4. Lighting Load

Q = Lamps* Time* Wattage/1000

= 1 Kwh/day

5. Equipment Load

Q = Fans* Time* Wattage/1000

= 6 Kwh/day

6. Infiltration Load

Q = Changes* Energy* Volume*(Outside Temperature – Inside Temperature)/3600

= 44.1 Kwh/day

Therefore,

Total Load = Sum of all loads:

256 Kwh/day ans.

2. A cold storage of dimension 10mx5mx3m. Outside and inside temperatures are 30°C and 6°C, while the floor temperature is 8°C. Overall heat transfer coefficient is 0.37 w/sqm°C. 2500 Kgs of apple are to be stored and 4 people work daily for four hours inside the cold storage and each person generates heat of 270 W. Specific heat of apple is 2.2 kJ $kg^{-1}°C^{-1}$. Enthalpy at 30°C DBT and 18.5°C WBT is 63 KJ/Kg of da. Enthalpy at 6°C and 90% RH is 20 KJ/Kg of da. 4 fans are used of motor capacity 120 W each and run for 10 hours. 4 Lamps are used of capacity 100 W each and run for 5 hours. If the plant operates for 18 hours daily, find out total load of storage (Consider 2 ACPH and respiration rate of product is 9.1 KJ/Kg/day).

Answer:

1. Transmission Load

Q = U*A*(Outside Temperature – Inside Temperature) *24/1000

= 0.37*140(30-6)24/1000

= 29.8 Kwh/day

For floor,

= 0.37*50(30-8)24/1000

= 9.8 Kwh/day

Total Transmission Load = 29.8 +9.8 = 39.6 Kwh/day

2.Product Load

Q = M*C_P*(Outside Temperature – Inside Temperature)/(3600)

= 36.6 Kwh/day

3. Occupancy Load

Q = persons* Time* Heat/1000

= 4.3 Kwh/day

4. Lighting Load

Q = Lamps* Time* Wattage/1000

= 2 Kwh/day

5. Equipment Load

Q = Fans* Time* Wattage/1000

= 4.8 Kwh/day

6. Infiltration Load

Q = Changes* Energy* Volume*(Outside Temperature – Inside Temperature)/3600

= 4.3 Kwh/day

7. Respiration load

Q = Mass X Respiration rate/3600

= 6.3 Kwh/day

Therefore,

Total Load = Sum of all loads:

= 98 Kwh/day

For 18 hours operation = 73.5 Kw ans.

3. Store Dimensions: 10mX6mX3m. Over all U Value - 0.24 w/sqm°C. Outside Design Conditions: 40°C DBT, 25°C WBT (Enthalpy = 94 KJ/Kg), Inside Design Conditions: 4°C+/-1 °C, 75%RH (Enthalpy = 13 KJ/Kg). Product: Daily 3000Kg/24 hrs coming at 30°C. Consider 2 men working for 4 hours daily. 4 fans are used of motor capacity 120 W each and run for 10 hours. 4 Lamps are used of capacity 100 W each and run for 5 hours. Consider specific heat of product is 2.5 KJ/Kg°C and 2 ACPH. Find out total load.

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Answer:

1. Transmission Load

Q = U*A*(Outside Temperature – Inside Temperature) *24/1000

= 44.7 Kwh/day

2.Product Load

Q = M*C_P*(Outside Temperature – Inside Temperature)/(3600)

= 54.1 Kwh/day

3. Occupancy Load

Q = persons* Time* Heat/1000

= 2.2 Kwh/day

4. Lighting Load

Q = Lamps* Time* Wattage/1000

= 2 Kwh/day

5. Equipment Load

Q = Fans* Time* Wattage/1000

= 4.8 Kwh/day

6. Infiltration Load

Q = Changes* Energy* Volume*(Outside Temperature – Inside Temperature)/3600

= 10.5 Kwh/day

Therefore,

Total Load = Sum of all loads:

118.3 Kwh/day ans.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration and Air-conditioning Skills

Session: 2021-22 (Summer Semester)

B. Voc. Program, V Semester,

2nd In-Sem. Examination

Time: 1 Hour

Course Code: HVA1503

Max. Marks: 20

Course Name: Chilled water supply system design

Section – A

05*01 = 05 Marks

Note: Each question carries 01 mark.

Q. 1: Efficiency of engine-drive screw chiller is

A. 1.6
B. 1.9
C. 3.25
D. 5.8

Q. 2: Efficiency of Electric-drive air-cooled scroll chiller is

A. 1.6
B. 1.9
C. 3.25
D. 5.8

Q. 3: Chillers operate efficiently in range of

A. 30% to 60% load
B. 40% to 80% load
C. 20% to 50% load
D. 10% to 70% load

Q. 4: A vapour absorption refrigeration system

A. gives noisy operation
B. gives quiet operation
C. requires more power consumption
D. have more wear and tear

Q. 5: In aqua-ammonia and Li-Br water absorption refrigeration system, the refrigerants are respectively

A. water and water
B. water and Li-Br
C. ammonia and Li-Br
D. ammonia and water

Section – B

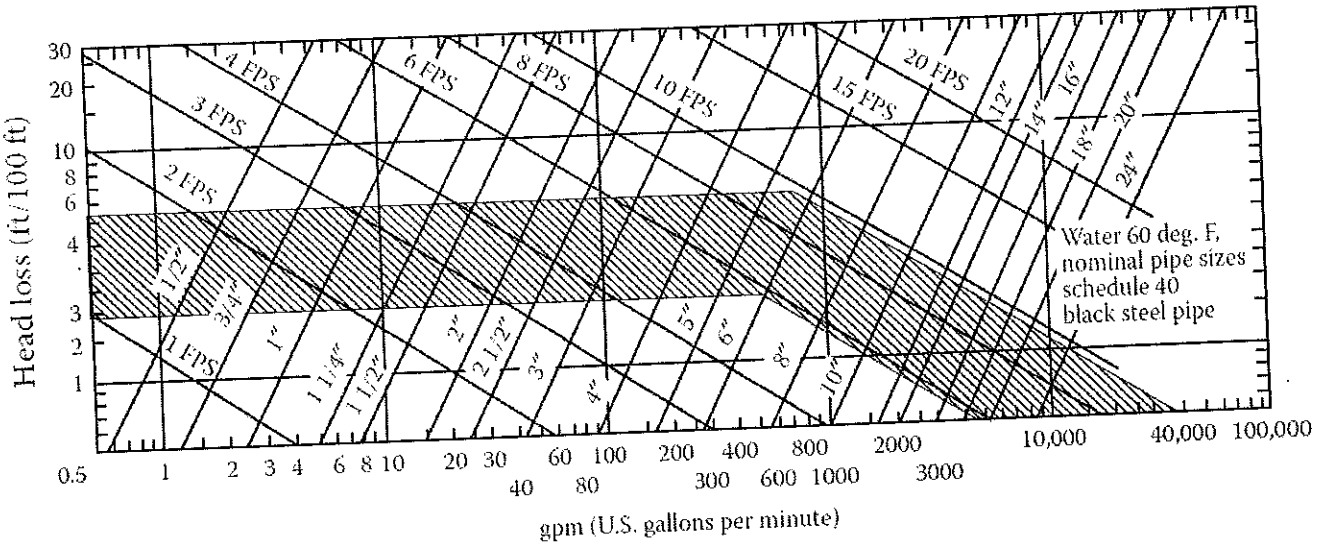
03*02 = 06 Marks

Note: Each question carries 02 mark.

Q. 1: Select the pipe sizes, having minimum and maximum head loss corresponds to 10000 GPM as shown in below figure. Write down head loss values also?

Q. 2: Explain line mounted and base mounted pumps.

Q. 3: What is the difference between symmetrical and asymmetrical chiller?



Section – C

03*03 = 09 Marks

Note: Each question carries 03 mark.

Q. 1: Explain series and parallel chiller system with neat sketch.

Q. 2: Explain vapour absorption refrigeration cycle with neat sketch.

Q. 3: Explain primary and secondary parallel configuration with neat sketch.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration and Air-conditioning Skills

Session: 2021-22 (Summer Semester)

B. Voc. Program, V Semester,

2nd In-Sem. Examination

Time: 1 Hour

Course Code: HVA1503

Max. Marks: 20

Course Name: Chilled water supply system design

Section – A

05*01 = 05 Marks

05 objective type questions, each question carries 01 mark.

Q. 1: A
Q. 2: C
Q. 3: B
Q. 4: B
Q. 5: D

Section – B

03*02 = 06 Marks

3 short answer type questions, each question carries 02 marks.

Q. 1: Select the pipe sizes, having minimum and maximum head loss corresponds to 10000 GPM as shown in below figure. Write down head loss values also?

Ans. Pipe size = 24" and head loss – 0.7 ft/100 ft (Minimum head loss)

Pipe size = 12" and head loss – 18 ft/100 ft (Maximum head loss)

Q. 2: Explain line mounted and base mounted pumps.

Ans. Line-mounted pumps: These pumps can be installed directly in the piping since the suction and discharge connections are arranged 180° apart. The motor and pump shafts, typically, are mounted vertically. The pump may be supported by the piping and/or by additional hangers or a foot stand.

Base-mounted pumps: Base-mounted pumps have the motor and pump shafts mounted horizontally, with both the pump and the motor bolted to a common frame or base. These pumps are available in two configurations.

Q. 3: What is the difference between symmetrical and asymmetrical chiller?

Ans. Symmetrical chiller: With this approach, all of the chillers are sized for equal capacity. The number of chillers and, thus, the size of the chiller "module" are based on the minimum anticipated load.

Asymmetrical chiller: There is no engineering rule that says that all chillers in a multichiller system have to be of the same size. While there may be some maintenance advantages (common parts, etc.), different-sized chillers can be operated together.

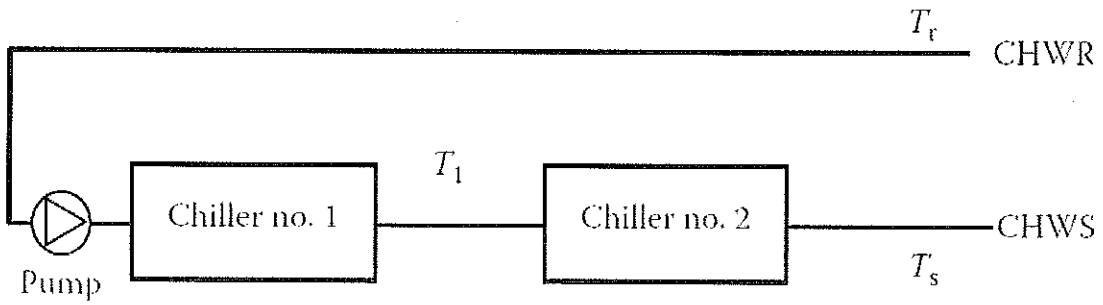
Section – C

03*03 = 09 Marks

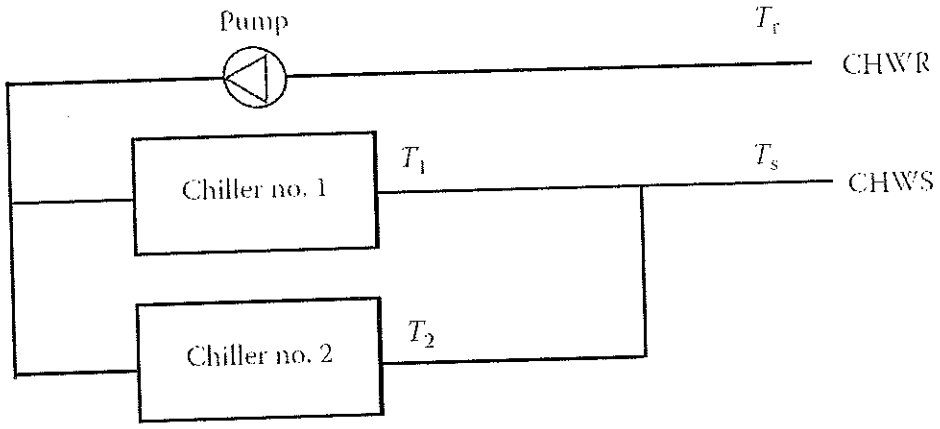
03 essay type questions, each question carries 03 marks.

Q. 1: Explain series and parallel chiller system with neat sketch.

Ans. Series chiller system: In a series configuration with two chillers, each chiller is selected to produce half of the required cooling at the full system flow rate. Thus, half of the total design range is produced by each chiller. Series chiller systems are rarely utilized in present times because this configuration requires a constant chilled water flow rate at all times, resulting in high pumping costs. But, if a relatively large temperature difference is required or if there is a very steady base cooling load, the series configuration may offer some advantages.



Parallel chiller system: The parallel chiller configuration is far more common. In a two-chiller configuration, each chiller is typically selected to operate with the same design range, but with only a half of the total system flow requirement. This again results in a 50/50 load split, but other load ratios may be selected if dictated by operational requirements. And, there is no real limitation on the number of parallel chillers that can be utilized in one system.



Q. 2: Explain vapour absorption refrigeration cycle with neat sketch.

Ans. In this system, the vapour refrigerant from the evaporator is drawn into an absorber where it is absorber by weak solution of the refrigerant forming a strong solution. This strong solution is pumped to the generator where it is heated by some external source (waste heat or solar energy). During the heating process, the vapour refrigerant is driven off by the solution and enters into the condenser where it is liquified. The liquid refrigerant then flows into the evaporator and thus the cycle is completed. The vapour absorption system uses heat energy, instead of mechanical energy as in VCRC. In VARS, the compressor is replaced by an absorber, a pump, a generator and a pressure reducing valve. These components in VARS perform the same function as that of a compressor in VCRC system.

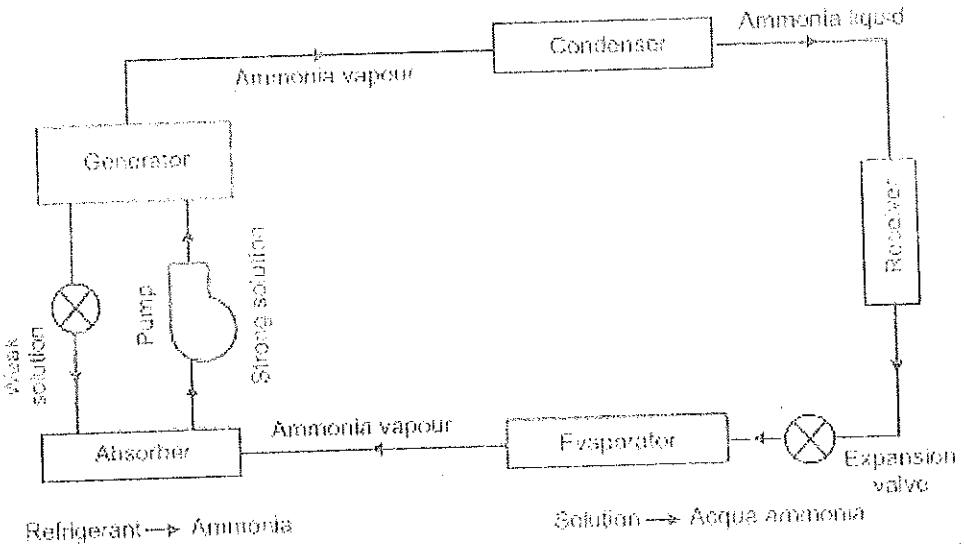
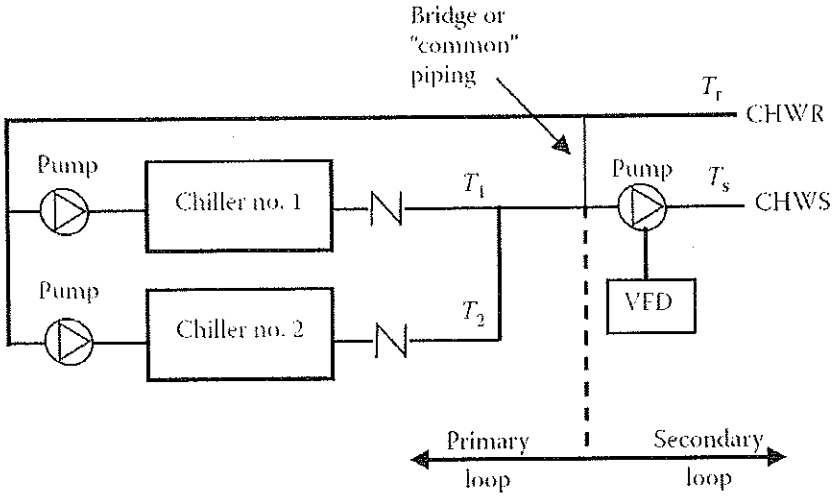


Fig. Vapour absorption refrigeration system

Q. 3: Explain primary and secondary parallel configuration with neat sketch.

Ans. In the primary–secondary variable flow piping arrangement, here, the production loop (primary loop) through the two chillers is hydraulically isolated from the distribution loop (secondary loop) by a piping bridge. The bridge is a short section of piping shared by both loops and designed to have little or no pressure drop. Thus, the flow in one loop is not affected by flow in the other. On the primary or production loop side, the system acts as

multiple-pump parallel chiller installation, as described earlier. Flow in this loop varies in "steps" as the chillers are staged on or off and their respective pumps are started and stopped. However, in the secondary or distribution loop, the cooling coils utilize two-way control valves and the distribution pump(s) utilize a variable frequency drive(s) (VFD) so that the chilled water flow rate is modulated from 0% to 100% of peak design flow as a function of the imposed cooling load. Thus, this loop has fully variable flow, but maintains a constant temperature range.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No : .....

School of Refrigeration & Air conditioning Skills

Session: 2020-21 (Winter Semester)

B. Voc. Program, V-Semester,

2nd InSem. Examination

Course Code: Hva1504 Time: 1 Hour

Course Name: AC system & Testing Max. Marks: 20

Instruction:

1.Read the question carefully.

2.use of calculator is allowed

Section – A 05X01 = 05 Marks

Q1) Ratio of max Dimension: minimum dimension is known as_____?

a) Aspect ratio b) Possession ratio

b) Pressure ratio d) dimension ratio

Q2) Ducting is classified according to _____?

a) Shapes b) Pressure

c) Velocity d) all the above

Q3) The friction value of chart is taken per ____ ft of duct length?

a)100 b)80

c)50 d)60

Q4) Duct with high pressure have _____ friction value of?

a) 6 ½ to 12 ¼ b) 3¼ to 4 ¼

c) 2 ½ to 8¼ d) 1 to 3 ¼

Q5) Evaporators of chillers are _____ categories as?

a) Shell & Tubes b) PHE

c)Coil & tube d) all the above

Section – B

03X02 = 06Marks

Q6) How ducts are designed, Name the methods along with variable to control?

Q7) what are the types of fittings used in ducting?

Q8) Using the continuity equation calculate the sizes of square duct?

whose area is

1)100 sq ft-10'x10' 2)156 sq inches-14"X14"

Section – C 03X03 =09Marks

Q9) What are the Advantages of velocity design in a system and why it is typical?

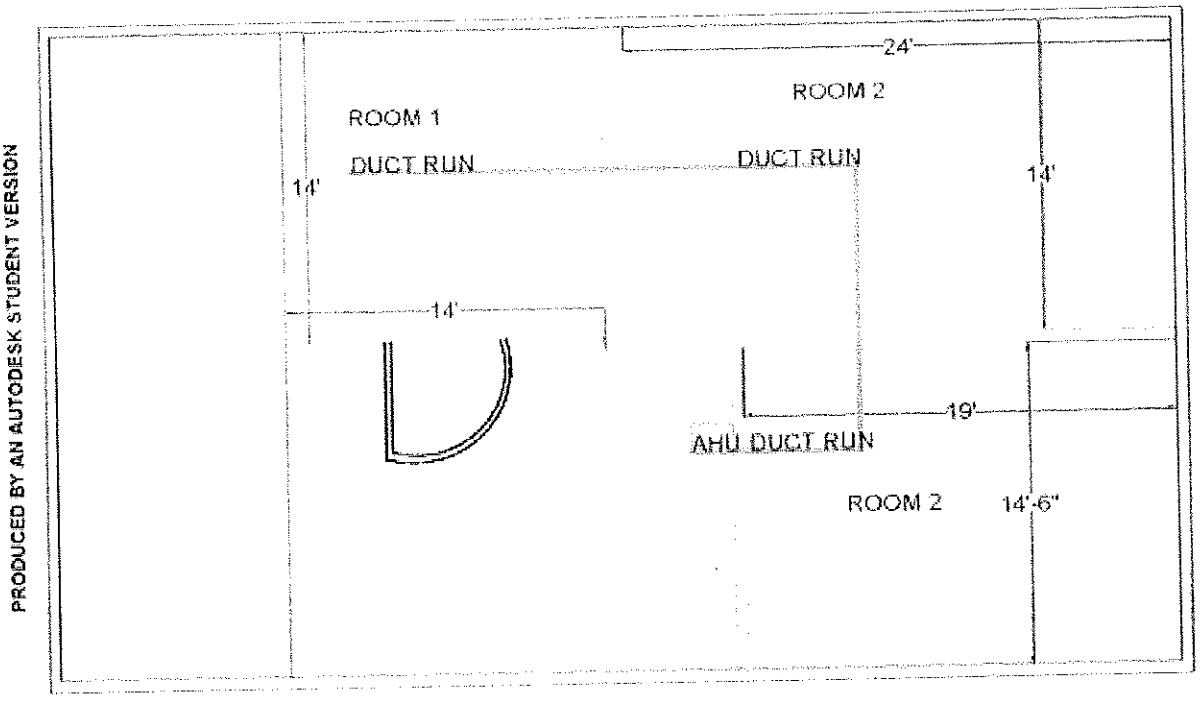
Q10) How are duct classified as

a) Velocity b) Shapes

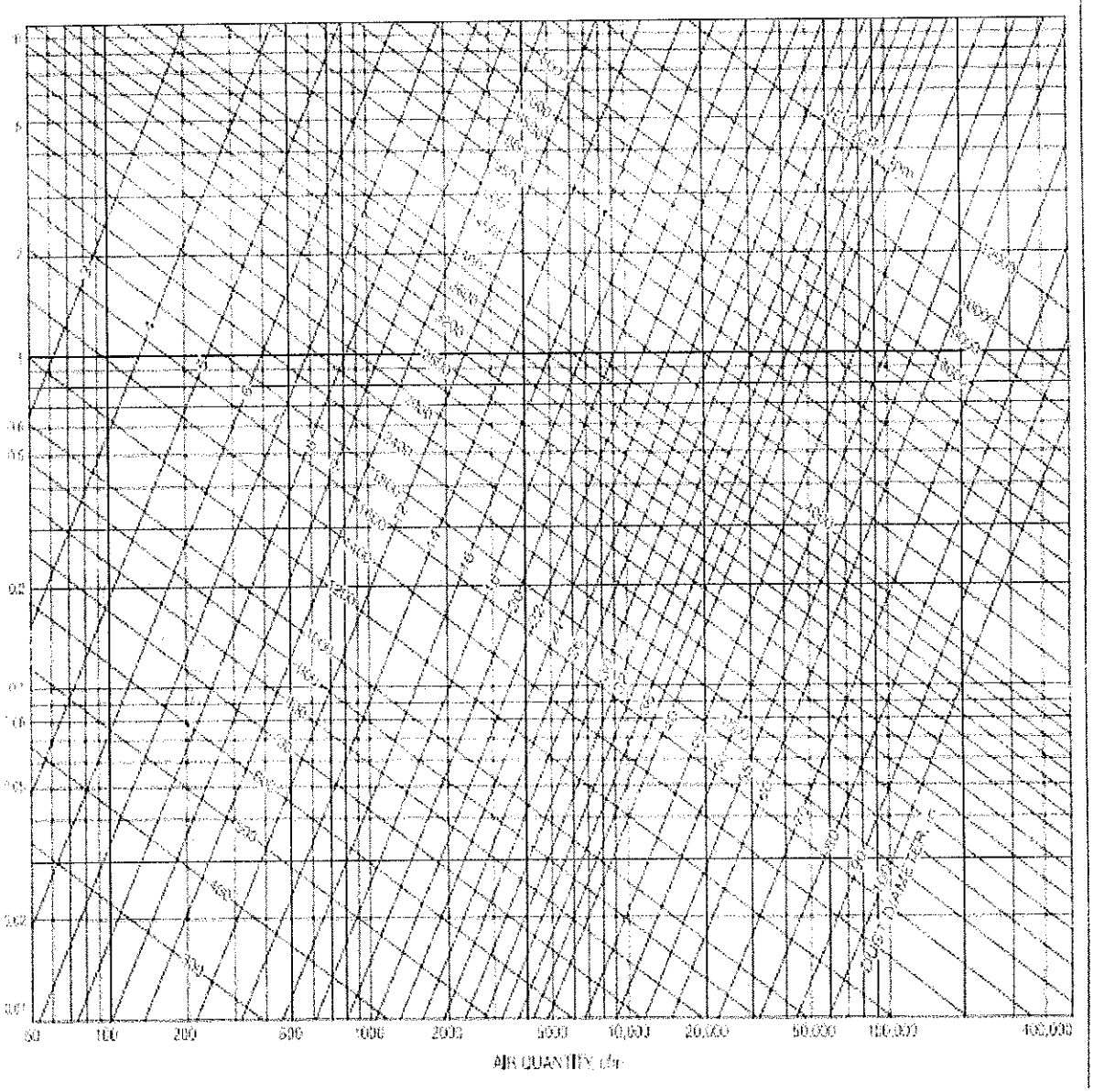
Q11) Calculate the required CFM and design the Duct for given building? Height to take 10.'

1) CFM of air required 2) Line diagram for duct design using EFM

DUCT	CFM	VELOCITY	PRESSURE AT	Square size duct
Room 1		400	0.05"	
Room 2		450	0.05"	
Room 3		400	0.05"	



1 CALCULATE CFM FOR ROOM 1,2 AND 3
2.WRITE DUCT DIMENSIONS
3.Make a table and fill in values for blanks



Source: ASHRAE Handbook 2013

Figure 2.7 : Rigid Duct Design - Friction Chart
Friction chart for Round Duct, Air Density = 0.075 lb/ft3 and ε = 0.0003 ft.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration & Air conditioning Skills

Session: 2020-21 (Winter Semester)

B. Voc. Program, V-Semester,

2nd InSem. Examination

Course Code: Hva1504 Time: 1 Hour

Course Name: AC system & Testing Max. Marks: 20

Instruction:

1.Read the question carefully.

2.use of calculator is allowed

Section – A 05X01 = 05 Marks

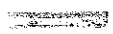
A1) a) Aspect ratio
A2) d) all the above
A3) a)100
A4) a) 6 ½ to 12 ¼
A5) d) all the above

Section – B

03X02 = 06Marks

A6) ducts are designed according to Three methods
1)EFM- velocity is controlled 2) Vrm- friction and 3)Static regain method- pressure in ducting
7)Types of fittings in ducting

-  Duct Clamps
-  90 Degree Elbows
-  Quick Fit Duct Pipes
-  Duct Reducers
-  Duct End Caps
-  Pipe Hangers
-  Press-On Collars with Dampers
-  Adjustable Nipples

-  Hose Adapters
-  Duct O-Rings
-  Angle Flanges
-  Tees
-  45 Degree Elbows
-  Connector Sleeve Fittings
-  Flex Connectors
-  Snap Lock Pipes
-  Angle Flange Adapters
-  Machine Adapters

Q8)100 sq ft = 10FT X10 FT
2)156 sq inches= 14"X14 "

Section – C 03X03 =09Marks

A9) It helps us in following ways.

1. Reduce duct sizes.
2. Reduces fan operational cost.
3. Help us in optimizing the system.
   It is typical as to balance we need dampers and experienced skilled person for making a project to balance each duct is difficult .it requires manipulation of Standards and hit trial method for balancing

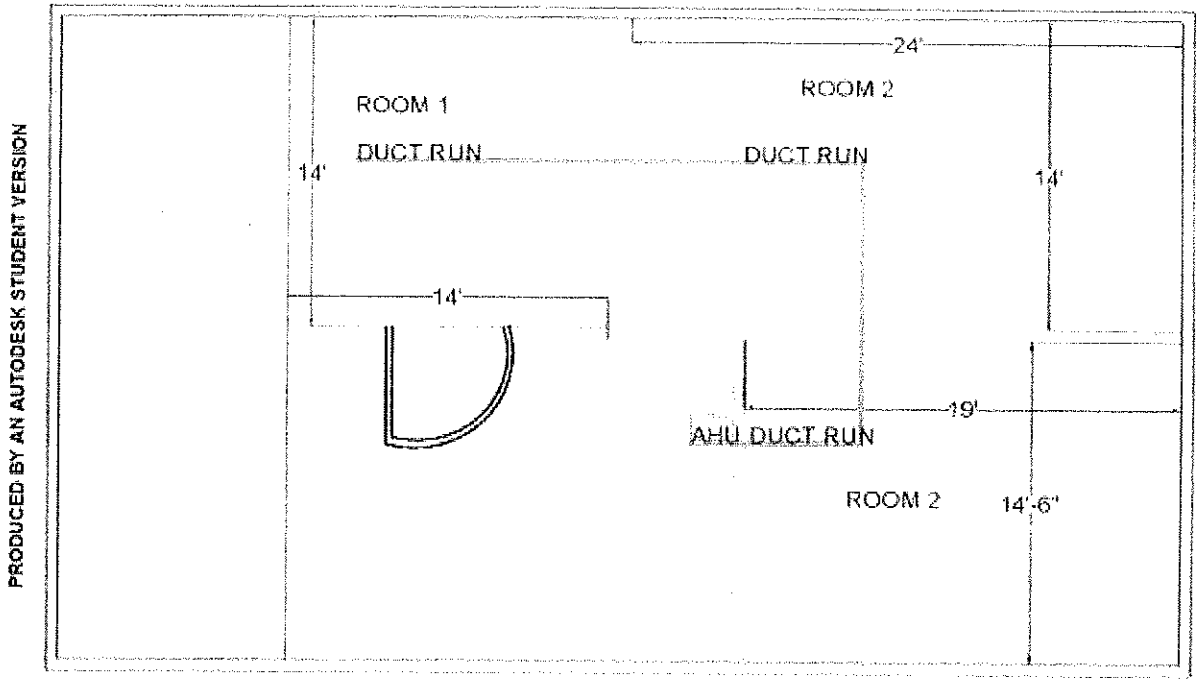
A10) Shapes -1ROUND
2)Square 3) Rectangle
4)Flat oval
B) Velocity- High above 2500 fpm
Medium- 1500-2500
Low velocity duct - up to 1500 fPm
A10) Classify & define the duct based on: -
Shapes- Round, Square, flat oval, and rectangular duct

b) Velocity with range
   a) High-above 2500 FPM
   b) Medium- 1500-2500 FPM
   c) Low-1500 FPM

A11) Calculate the required CFM and design the Duct for given building? Height to take 10.'

1) CFM of air required 2) Line diagram for duct design using EFM

DUCT	CFM	VELOCITY	PRESSURE AT	Square size D equivalent
Room 1	672	400	0.05"	10"x10"
Room 2	800	450	0.05"	4"x4"
Room 3	440	400	0.05"	5"x5"



1.CALCULATE CFM FOR ROOM 1,2 AND 3
2.WRITE DUCT DIMENSIONS
3.Make a table and fill in values for blanks