BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration and Air-conditioning Skills

Session: 2021-22 (Winter Semester)

B. Voc. Program, III Semester,

2nd In-Sem. Examination

Course Code: HVA1301 **Time: 1 Hour**

Course Name: Psychrometry & System Design **Max. Marks: 20**

Section – A

05*01 = 05 Marks

Note: Each question carries 01 mark.

Q. 1: Which of the following is not an internal load?

A. Infiltration
B. People
C. Appliances
D. None of the above

Q. 2: R-410A is which type of refrigerant blend?

A. Zeotropic
B. Azeotropic
C. Inorganic
D. None of the above

Q. 3: Solar gain depends on :-

A. Latitude of the location
B. Orientation of the building
C. U-factor of the material
D. All of the above

Q. 4: What is the nominal thermal comfort temperature for humans.

A. 75 °F
B. 85 °F
C. 65 °F
D. None of the above

Q. 5: Which of the following is not an unit of humidity ratio?

A.gr/lb
B. kg/kg
C. g/kg
D. None of the above

Section – B

03*02 = 06 Marks

Note: Each question carries 02 mark.

Q. 1: What is specific heat and its impact on a refrigerant?

Q. 2: What do you mean by latent heat of vaporization?

Q. 3: What do you mean by miscibility of oil in refrigerant?

Section – C

03*03 = 09 Marks

Note: Each question carries 03 mark.

Q. 1: What are the different categories of refrigerant?

Q. 2: Explain flammability and toxicity?

Q. 3: Explain the relation between pressure and temperature for a refrigerant and its role in determining freezing and boiling point of a refrigerant.

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B. Voc. Program, III Semester,

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Course Code: HVA1301 **Time: 1 Hour**

Course Name: Psychrometry & System Design **Max. Marks: 20**

Section – A

05*01 = 05 Marks

05 objective type questions, each question carries 01 mark.

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

Section – B

03*02 = 06 Marks

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

1. Specific heat capacity is the amount of heat required to change temperature of a given quantity of a substance by one degree. Specific heat may be measured in Btu/lb °F or kJ/kg °K. Different substances have different heat holding capabilities and thermal properties. Just because 1 Lb. of water will change precisely through 1° F when 1 BTU is applied to it does not necessarily mean that the same thing will happen with 1 Lb. of copper or 1 Lb.
2. The latent heat of vaporization or evaporation (Lv) is the heat that has to be given to a unit mass of material to convert it from the liquid to the vapor phase without a change in temperature.

3. Miscibility is typically studied by mixing known concentrations of refrigerant and oil and lowering the temperature until a phase separation is observed. The results are used to plot a curve of temperature versus concentration which indicates how cold a mixture can go before causing separation of an oil-rich phase.

Section – C

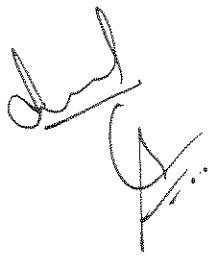
03*03 = 09 Marks

03 essay type questions, each question carries 03 marks.

1. CFC = ChloroFluoroCarbons. ...
    - HCFC = HydroChloroFluoroCarbons. ...
    - HFC = HydroFluoroCarbons. ...
    - FC = FluoroCarbons. ...
    - HC = HydroCarbons. ...
    - NH3 = Ammonia. ...
    - CO2 = Carbon Dioxide

2. Flammability of a refrigerant is its ability to burn or ignite, causing fire or combustion. The degree of difficulty required to cause the combustion of a substance is quantified through fire testing and dependent on a number parameters. Freon is a dangerous substance. This almost odorless and tasteless gas can cause severe symptoms if a person inhales too much at once. Because refrigerants cut off the oxygen supply, some people use the gas to get high. This is very dangerous, as breathing in refrigerants in high concentrations or large amounts can lead to death.

3. The pressure of a given amount of gas is directly proportional to the temperature at a given volume. When the temperature of a system goes up, the pressure also goes up, and vice versa. The relationship between pressure and temperature of a gas is stated by the Gay-Lussac's law



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Registration No.: .....

School of Refrigeration & Air conditioning Skills

Session: 2021-22 (Winter Semester)

B. Voc. Program, III-Semester,

2nd In-Sem. Examination

Course Code: RAC 1302 **Time: 1 Hour**

Course Name: Central air-conditioning system practices **Max. Marks: 20**

Instruction: Read the question carefully, do attempt all

Section – A

05*01 = 05 Marks

Q1) Ratio of maximum dimension to minimum dimension is known as?

a. Aspect ratio b. possession ratio
c. Pressure ratio d. dimension ratio

Q2) ducting is classified according to_____?

a. Shapes b. pressure
c. velocity d. all of the above

Q3) Friction value of chart is taken per_____ ft of duct length?

a. 100 b. 200
c. 10 d. 50

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

a. 6.5 to 12.25 b. 3.5 to 4.25
c. 2.5 to 8.25 d. 1 to 3.25

Q5) Evaporators of chillers are _____ categories as?

a. Shell and tube b. PHE
c. Coil and tube d. all of the above

Section – B

03*02 = 06 Marks

Q1) Define: CFM, FPM and area. Write relation among them.
Q2) Write down the name of duct sizing methods.
Q3) Mention the various types of pressure in the duct system with their application?

Section – C

03*03 = 09 Marks

Q1) Explain duct components with neat sketch?
Q2) Write types of duct materials along with application?
Q3) Explain converging, diverging and constant cross-sectional areas with neat sketch?

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Registration No.: .....

School of Refrigeration & Air conditioning Skills

Session: 2021-22 (Winter Semester)

B. Voc. Program, III-Semester,

2nd In-Sem. Examination

Course Code: RAC 1302 **Time: 1 Hour**

Course Name: Central air-conditioning system practices **Max. Marks: 20**

Answer key

Section – A

05*01 = 05 Marks

A1) A
A2) D
A3) A
A4) A
A5) D

Section – B

03*02 = 06 Marks

A 1. Define: CFM, FPM and area. Write relation among them.

- **CFM:** volume of air flow; cubic feet/minute
- **FPM:** velocity or speed of air flow; feet/minute
- **Area (sq.ft):** duct size or cross-sectional area; square feet

Relation, CFM = FPM*Area

A 2. Write down the name of duct sizing methods.

1. Equal friction method
2. Velocity reduction method
3. static regain method

A 3. Mention the various types of pressure in the duct system with their application?

Duct system is pressurized by three pressures:

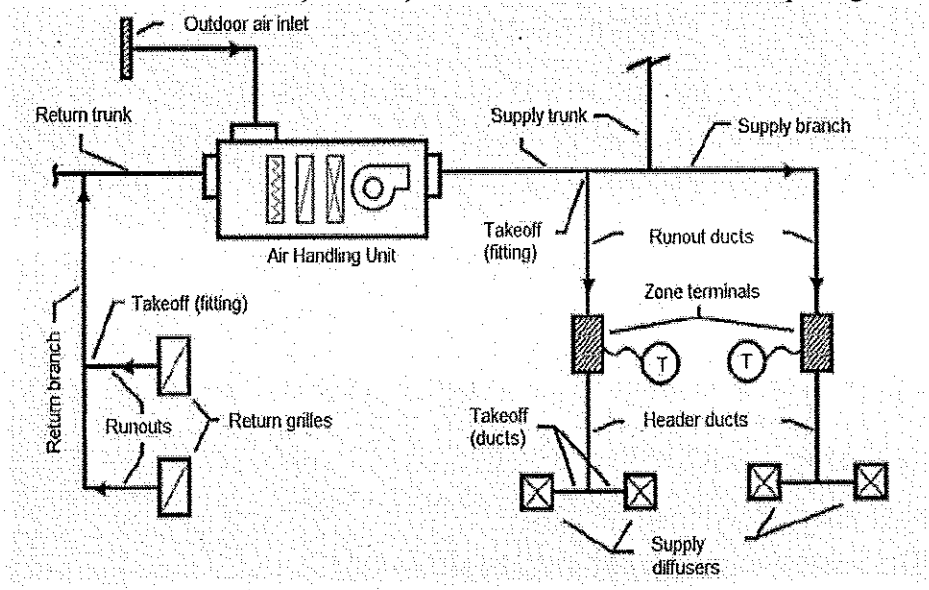
- Static pressure: It is the air pressure in the duct, which is used for fan selection.
- Velocity pressure: It is the pressure generated by the velocity and weight of the air, which is used for measuring the flow (cfm) in a system.
- Total pressure: It is used to find velocity pressure. Static pressure plus velocity pressure equals total pressure.

Pressure in the ductwork is measured in inches of water column (in-wc).

Section – C 03*03 = 09 Marks

A 1. Explain duct components with neat sketch?

1. Supply air ductwork supplies conditioned air from the air handling unit to the conditioned area.
2. Return air ductwork removes air from the conditioned building spaces and returns the air to the air handling unit, which reconditions the air. In some cases, part of the return air in this ductwork is exhausted to the building exterior.
3. Fresh air ductwork supplies outdoor air to the air handling unit. Outdoor air is used for ventilating the occupied building space.
4. Exhaust (relief) air ductwork carries and discharges air to the outdoors. Exhaust air is taken from toilets, kitchen, laboratories and other areas requiring ventilation.



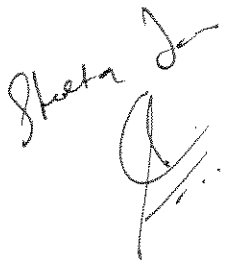
A 2. Write types of duct materials along with application?

1. Galvanized Steel: It is a standard, most common material used in fabricating ductwork for most comfort air conditioning systems.
2. Aluminum: It is widely used in clean room applications. These are also preferred systems for moisture laden air, special exhaust systems and ornamental duct systems.
3. Stainless Steel: It is used in duct systems for kitchen exhaust, moisture laden air, and fume exhaust.
4. Copper: It is mainly used for certain chemical exhaust and ornamental ductwork.
5. Fiber-glass Reinforced Plastic (FRP)
6. PVC
7. Fabric

A 3. Explain converging, diverging and constant cross-sectional areas with neat sketch?

Static and velocity pressure are mutually convertible. The magnitude of each is dependent on the local duct cross-section which determines the flow velocity. The following pressure changes are affected in the ducts:

- **Constant cross-sectional areas:** Total and static losses are equal.
- **Diverging sections (increase in duct size):** Velocity pressure decreases, total pressure decreases, and static pressure may increase (static regain).
- **Converging sections (decrease in duct size):** Velocity pressure increases in the direction of flow, total and static pressure decrease.



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Registration No.: .....

School of RAC Skills

Session: 2021-22 (Winter Semester)

B. Voc. Program, 1st Semester,

2nd In-Sem. Examination

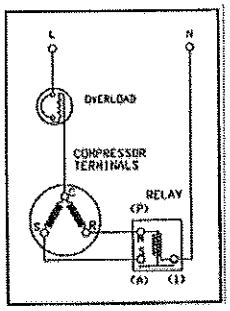
Course Code: RAC1303 **Time: 1 Hour**

Course Name: RAC Electrical, Electronics and Instrumentation-II **Max. Marks: 20**

Section – A

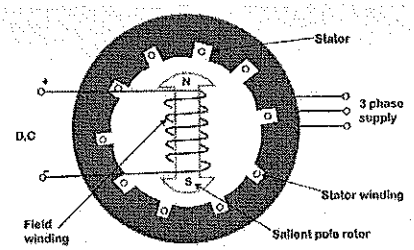
05X01 = 05 Marks

1. This diagram represents _____ motor.



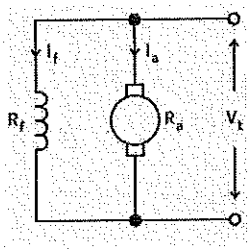
   a. Single Phase
   b. PSC
   c. RSIR
   d. CSIR

2. This diagram represents _____ motor.



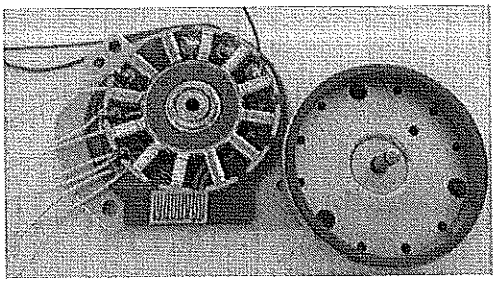
   a. 3 phase induction motor
   b. BLDC motor
   c. Synchronous Motor
   d. DC rotor motor

3. This diagram represents _____ motor.



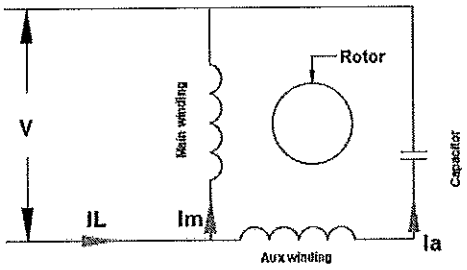
   a. DC Motor
   b. Series DC motor
   c. Shunt DC Motor
   d. Induction Motor

4. This diagram represents _____ motor.



a. BLDC
b. PSC
c. Shaded pole
d. Multi Pole

5. This diagram represents _____ motor.



a. PSC
b. RSIR
c. Induction
d. DC Motor

Section – B

03X02 = 06 Marks

6. What are the various use and advantage of VFD?
7. What are the differences between squirrel cage and slip ring rotor?
8. What is self and mutual induction?

Section – C

03X03 = 09 Marks

1. Explain the fault-finding procedure of a compressor.
2. Explain the difference between AC and DC motors
3. What are the various types and application of DC brushed motor, explain with clean diagrams?

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Registration No.: .....

School of RAC Skills

Session: 2021-22 (Winter Semester)

B. Voc. Program, 1st Semester

2nd In-Sem. Examination

Course Code: RAC1303 **Time: 1 Hour**

Course Name: RAC Electrical, Electronics and Instrumentation-II **Max. Marks: 20**

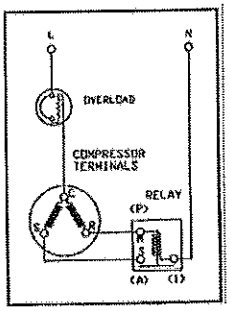
Instruction: Attempt all questions

Answer Sheet

Section – A

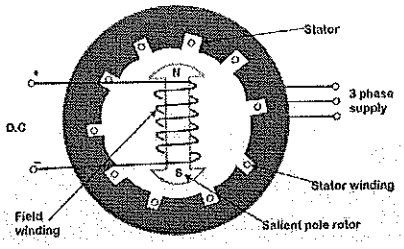
05X01 = 05 Marks

1. This diagram represents _____ motor.



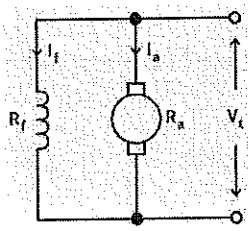
   a. Single Phase
   b. PSC
   c. RSIR
   d. CSIR

2. This diagram represents _____ motor.



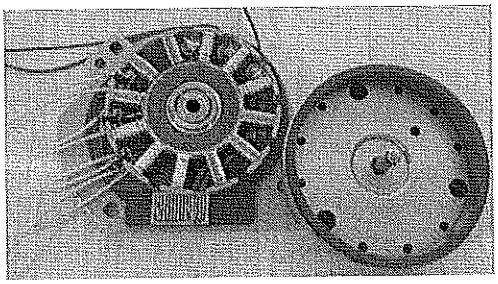
   a. 3 phase induction motor
   b. BLDC motor
   c. Synchronous Motor
   d. DC rotor motor

3. This diagram represents _____ motor.



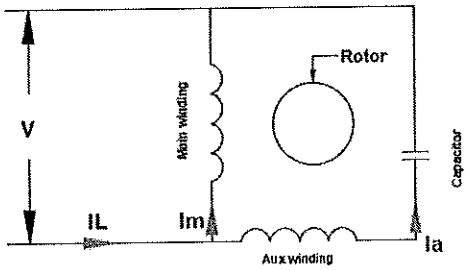
   a. DC Motor
   b. Series DC motor
   c. Shunt DC Motor
   d. Induction Motor

4. This diagram represents _____ motor.



a. **BLDC**
b. PSC
c. Shaded pole
d. Multi Pole

5. This diagram represents _____ motor.



a. **PSC**
b. RSIR
c. Induction
d. DC Motor

Section – B

03X02 = 06 Marks

6. What are the various use and advantage of VFD?

Answer: Keeps starting current in control. A VFD has the capability of starting the motor at zero voltage and frequency. Reduces power line disturbances. Demands lower power on start. Helps in controlling operating speed and acceleration. Limits and adjusts torque: The drive is capable of limiting and adjusting the amount of torque so the ac motor never surpasses this limit. This protects machinery from damage and protects the process or product. Saves energy and cost.

7. What are the differences between squirrel cage and slip ring rotor?

Answer:

S.No	Single Cage	Double Cage
1	It has low rotor resistance and motor draws high starting current.	The outer cage bars have high resistance and the motor draws low current.
2	The small rating single cage motor can be started on direct online.	The double cage motor up to 200 KW rating can be started on direct online.
3	Starting torque is low.	Starting torque is high.
4	The breakdown torque or maximum torque is more.	The breakdown or maximum torque is smaller because the two cages produce maximum torque
5	The leakage reactance is low.	The effective leakge reactance is high
6	The effective rotor resistance is low hence low rotor heating at start.	The effective rotor resistance is high hence more rotor heating at start.

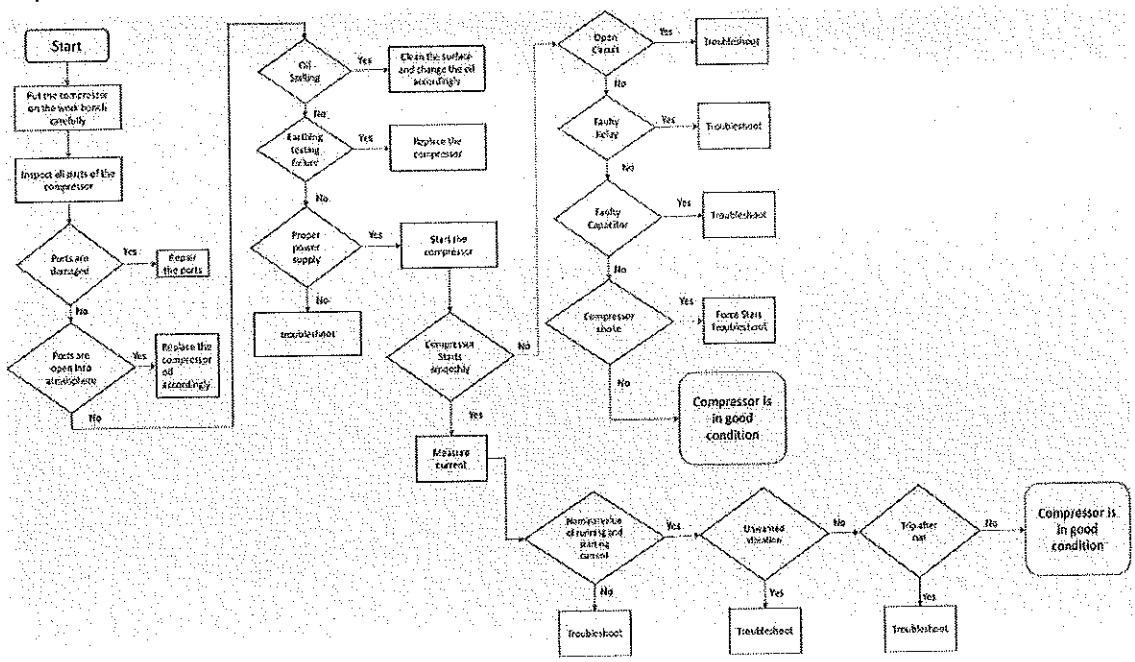
8. What is self and mutual induction?

In self inductance, the change in the strength of current in the coil is opposed by the coil itself by inducing an e.m.f.	In mutual inductance out of the two coils one coil opposes change in the strength of the current flowing in the other coil.

Section – C

03X03 = 09 Marks

1. Explain the fault-finding procedure of a compressor.



2. Explain the difference between AC and DC motors

Answer: The most obvious difference is the type of current each motor turns into energy, alternating current in the case of AC motors, and direct current in the case of

DC motors. AC motors are known for their increased power output and efficiency, while DC motors are prized for their speed control and output range.

3. What are the various types and application of DC brushed motor, explain with clean diagrams?

Answer: Applications of Brushed DC motor

Though these motors mainly use in household appliances and in automobiles.

These motors still use for industrial purposes for both low and high power, fixed and variable speed electric drives.

They still use for paper machines, cranes, electrical propulsion, sewing machines, power tools, and steel rolling mills.

Series DC Motors

In a series DC motor, the field is wound with a few turns of a large wire carrying the full armature current. Typically, series DC motors create a large amount of starting torque, but cannot regulate speed and can even be damaged by running with no load.

Shunt DC Motors

In shunt DC motors the field is connected in parallel (shunt) with the armature windings..

Compound DC Motors

Compound DC motors, like shunt DC motors, have a separately excited shunt field. Compound DC motors have good starting torque but may experience control problems in variable speed drive applications.

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School of RAC Skills

V Semester, 2nd In-Sem. Examination

B. Voc. Program, Winter Semester (2022-23)

Course Code: RAC1304 Time: 1 Hour

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

Instruction:

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

Section – A

05X01 = 05 Marks

1. Which source play a major role in a cold storage.
   a. Transmission Load
   b. Product Load
   c. Infiltration Load
   d. None of the above
2. What is the approx. storage temperature for fish?
   a. -20 °C
   b. -25 °C
   c. -30 °C
   d. none of the above
3. LIFO stands for-.
   a. Last in first out
   b. Late in first out
   c. Low in full out
   d. None of the above
4. Psychrometry is the study of-
   a. moist air
   b. stasis point
   c. metrics in Canada
   d. none of the above
5. In which direction cold air spills out?
   a. Upward
   b. Downward
   c. Horizontal
   d. None of the above

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Section – B

03X02 = 06 Marks

1. Write down the different sources of load gain in cold storages.
2. A cold Store with Dimension 10mX5mX4m. U Value for Walls- 0.24. Outside Design Conditions: 39°C DBT, 25°C WBT. Inside Design Conditions: 4°C, 75% RH Product: Daily 2500Kg/24 hrs coming at 30°C. Consider 2 men working for 4 hours daily. Find out the Load.
3. 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} $°C^{-1}$).

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. Each cubic meter of new air provides 2KJ/cm°C. Find out total load.
2. A cold room with dimension 10mX8mX6m. 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: 5°, 75%RH. Daily 2000Kg/24 hrs coming at 35°C with specific heat 3.0 KJ/Kg°C and 4 APCH. Each cubic meter of new air provides 2KJ/cm°C. Consider 4 fan motors rated 250 w working for 10 hours daily. Find out total load.
3. Following data given for a cold room:
   Store Dimensions: 10mX6mX3m
   Over all U Value - 0.24 w/sqm°C
   Outside Conditions: 40°C DBT, 25°C WBT
   Inside Conditions: 5°C, 75%RH
   Person: 5 for 5 hours daily working inside
   Lamps: 4 of 200 w each and used for 5 hours daily.
   By using above data find out total load.

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School of RAC Skills

III Semester, 2nd In-Sem. Examination

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

Course Code: RAC1304 Time: 1 Hour

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

Instruction:

Section – A

05X01 = 05 Marks

1. Which source play a major role in a cold storage.
   a. Transmission Load

2. What is the approx. storage temperature for fish?
   b. -25 °C

3. LIFO stands for-.
   a. Last in first out

4. Psychrometry is the study of-
   a. moist air

5. In which direction cold air spills out?
   b. Downward

Section – B

03X02 = 06 Marks

1. Write down the different sources of load gain in cold storages.

Answer: Following are the load sources:

a) Transmission Load
b) Product Load
c) Occupancy Load
d) Lighting Load
e) Infiltration Load
f) Equipment Load
g) Respiration Load

2. A cold Store with Dimension 10mX5mX4m. U Value for Walls- 0.24. Outside Design Conditions: 39°C DBT, 25°C WBT. Inside Design Conditions: 4°C, 75% RH Product: Daily 2500Kg/24 hrs coming at 30°C with specific heat capacity 2.5 kJ kg^{-1} $°C^{-1}$. Consider 2 men working for 4 hours daily. Find out the Load.

Answer: Transmission Load

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

= 0.24*220(39-4) *24/1000

total transmission load = 44.3 Kwh/Day

Product Load

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

= 45.1 Kwh/Day

Occupancy Load

Q = persons* Time* Heat/1000

= 4 Kwh/Day

Total Load = 93.4 Kwh/Day ans.

3. A cold room of size 20mx15mx8m. Outside and inside temperatures are 30°C and 6°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: Transmission Load

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

= 0.37*1160(30-6) *24/1000

total transmission load = 247 Kwh/Day

Product Load

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

= 73.3 Kwh/Day

Occupancy Load

Q = persons* Time* Heat/1000

= 4.32 Kwh/Day

Total Load = 324.62 Kwh/Day ans.

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. Each cubic meter of new air provides 2KJ/cm°C. Find out total load.

Answer: Transmission Load

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

= 0.35*550(35-4) *24/1000

total transmission load = 143 Kwh/Day

Product Load

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

= 64.5 Kwh/Day

Occupancy Load

Q = persons* Time* Heat/1000

= 4 Kwh/Day

Infiltration Load

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

= 25.8 Kwh/Day

Total Load = 237.3 Kwh/Day ans.

2. A cold room with dimension 10mX8mX6m. 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: 5°, 75%RH. Daily 2000Kg/24 hrs coming at 35°C with specific heat 3.0 KJ/Kg°C and 4 APCH. Each cubic meter of new air provides 2KJ/cm°C. Consider 4 fan motors rated 250 w working for 10 hours daily. Find out total load.

Answer: Transmission Load
Q = U*A*(Outside Temperature – Inside Temperature) *24/1000
= 0.35*376(35-5) *24/1000
total transmission load = 94.7 Kwh/Day

Product Load

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

= 50 Kwh/Day

Equipment Load

Q = Fan* Time* Watt/1000

= 10 Kwh/Day

Infiltration Load

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

= 32 Kwh/Day

Total Load = 186.7 Kwh/Day ans.

3. Following data given for a cold room:
   Store Dimensions: 10mX6mX3m
   Over all U Value - 0.24 w/sqm°C
   Outside Conditions: 40°C DBT, 25°C WBT
   Inside Conditions: 5°C, 75%RH
   Person: 5 for 5 hours daily working inside
   Lamps: 4 of 200 w each and used for 5 hours daily.
   By using above data find out total load.

   Answer: Transmission Load
   Q = U*A*(Outside Temperature – Inside Temperature) *24/1000
   = 0.24*360(40-5) *24/1000
   total transmission load = 207.4 Kwh/Day

   Occupancy Load

   Q = persons* Time* Heat/1000

   = 6.2 Kwh/Day

Equipment Load

Q = Fan* Time* Watt/1000

= 4 Kwh/Day

Total Load = 237.3 Kwh/Day ans.