Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of RAC Skills

III Semester, 2nd In-Sem. Examination

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

Course Code: RAC1301 **Time: 1 Hour**

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

Instruction:

Attempt all Questions.

Section – A

05X01 = 05 Marks

1. Which of the following is an example of a blend?
   a. R-502
   b. R-134a
   c. R-32
   d. None of the above

2. Which of the following is not a refrigerant safety Group:
   a. A1
   b. B3
   c. D1
   d. B2

3. Miscibility of a refrigerant is associated with its: -
   a. Oil
   b. Pressure
   c. Vapor
   d. Temperature

4. Which of the following is not a greenhouse gas:
   a. CO2
   b. CH4
   c. O3
   d. N2O

5.U- value of a material is its:
   a. Resistance
   b. Conductance
   c. Thickness
   d. None of the above

Section – B

03X02 = 06 Marks

1. What is ODP of a refrigerant?
2. Why is inertness of a refrigerant important?
3. How does CFC's affect the ozone layer?

Section – C

03X03 = 09 Marks

1. Write about any three thermodynamic properties of refrigerant.

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2. What are the sources of internal gains in a building and how do you calculate it?
3. What are your responsibilities as an employer and supervisor while handling refrigerants?

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ANSWER SHEET

III Semester, 2nd In-Sem. Examination

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

Course Code: RAC1301 **Time: 1 Hour**

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

Instruction:

1. Attempt all Questions.

Section – A

05X01 = 05 Marks

1. A

2. C

3. A

4. C

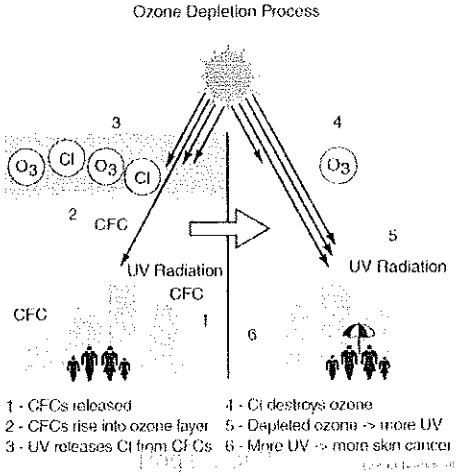
5.b

Section – B

03X02 = 06 Marks

1. Ozone Depletion Potential (ODP): According to the Montreal protocol, the ODP of refrigerants should be zero, i.e., they should be non-ozone depleting substances. Refrigerants having non-zero ODP have either already been phased-out (e.g. R 11, R 12) or will be phased-out in near-future(e.g. R22).
2. It should be chemically stable for the operating ranges of temperature. Also, it should not react with the materials of the refrigeration system or with which it comes into contact.

3.



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Section – C

03X03 = 09 Marks

1. Specific Heat

The specific heat of the liquid should be as small as possible. This ensures that the irreversibilities associated with throttling are small and there is greater subcooling of the liquid. On the other hand, the specific heat of vapor should be high to have less superheating of the vapor.

Enthalpy of Vaporization

This should be as large as possible to minimize the area under superheat and the area reduction due to throttling. Also, the higher value of enthalpy of vaporization lowers the required flow rate per ton of refrigeration.

2. Sources of internal gains are People lighting and equipment.

They are calculated using Load Data from ISHRAE

3.

The supervisor must ensure that workers work in the manner and with the protective devices, measures and procedures required by The Act and the Regulations; 2. workers use or wear the equipment, protective devices or clothing that the employer requires to be used or worn; workers are advised of any potential or actual danger to their health or safety; workers are provided with instructions as to the measures and procedures to follow for their protection.

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Registration No.: .....

School of Refrigeration & Air conditioning Skills

Session: 2021-22 (Summer Semester)

B. Voc. Program, V-Semester,

2nd In-Sem. Examination

Course Code: RAC 1302 Time: 1 Hour

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

Instruction:

1.Read the question carefully, do attempt all 2.Use of calculator is allowed

Section – A

05X01 = 05 Marks

Q1) To calculate Cfm of a space _____ is used?

a. Volume b. Area

c. Cross section d. Surface area

Q2) The friction value of chart is taken per ____ ft of duct length?

a.100 b.80

c. 50 d. 60

Q3) Psychrometry is the study of _____?

a. Moist air b. Dry air

c. Dew point air d. None of these

Q4) Chiller are ____&_____ cooled?

a. Air & water b. dry & wet

c. Moist & Vapor d. pressure vs Enthalpy

Q5) Evaporators of chillers are _____ categories as?

a. Shell & Tubes b. PHE

c. Coil & tube d. all the above

Section – B

03X02 = 06 Marks

Q6) What are the types of evaporators used in chiller?

Q7) What is ventilation explain?

Q8) what are the Types of ducts according to pressure?

Section – C

03X03 = 09 Marks

Q1) Types of ventilation used along with application?

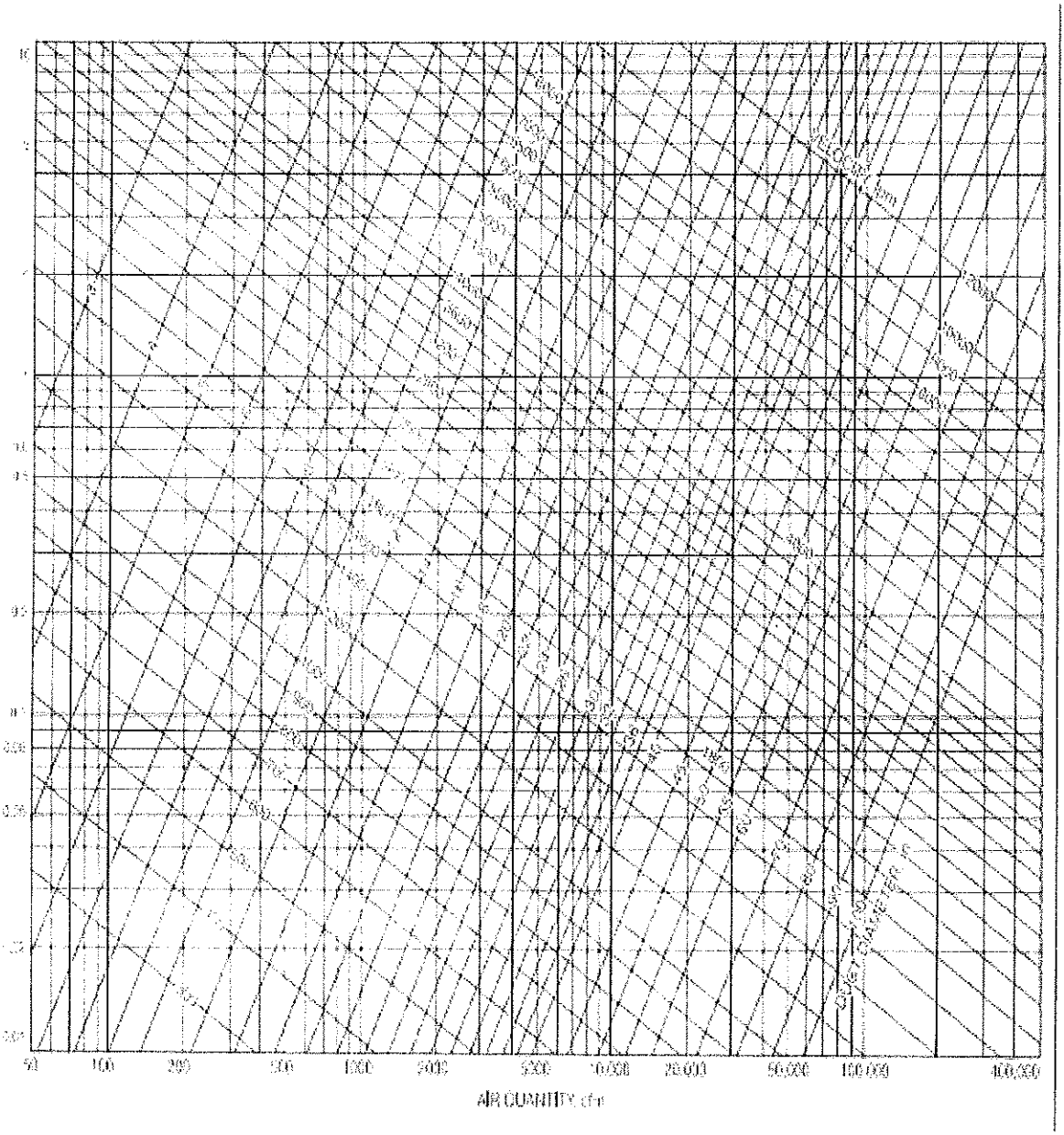
Q2) Calculate the required CFM and design the Duct for given building? Height to take 10.'

1) CFM of air required

DUCT	CFM	VELOCITY	PRESSURE AT	Duct size D equivalent
Room 1		400	0.05"	
Room 2		450	0.05"	

Room 3		420	0.05"	

Q3) In a central Chiller plant Draw and explain the component with cycle?



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.

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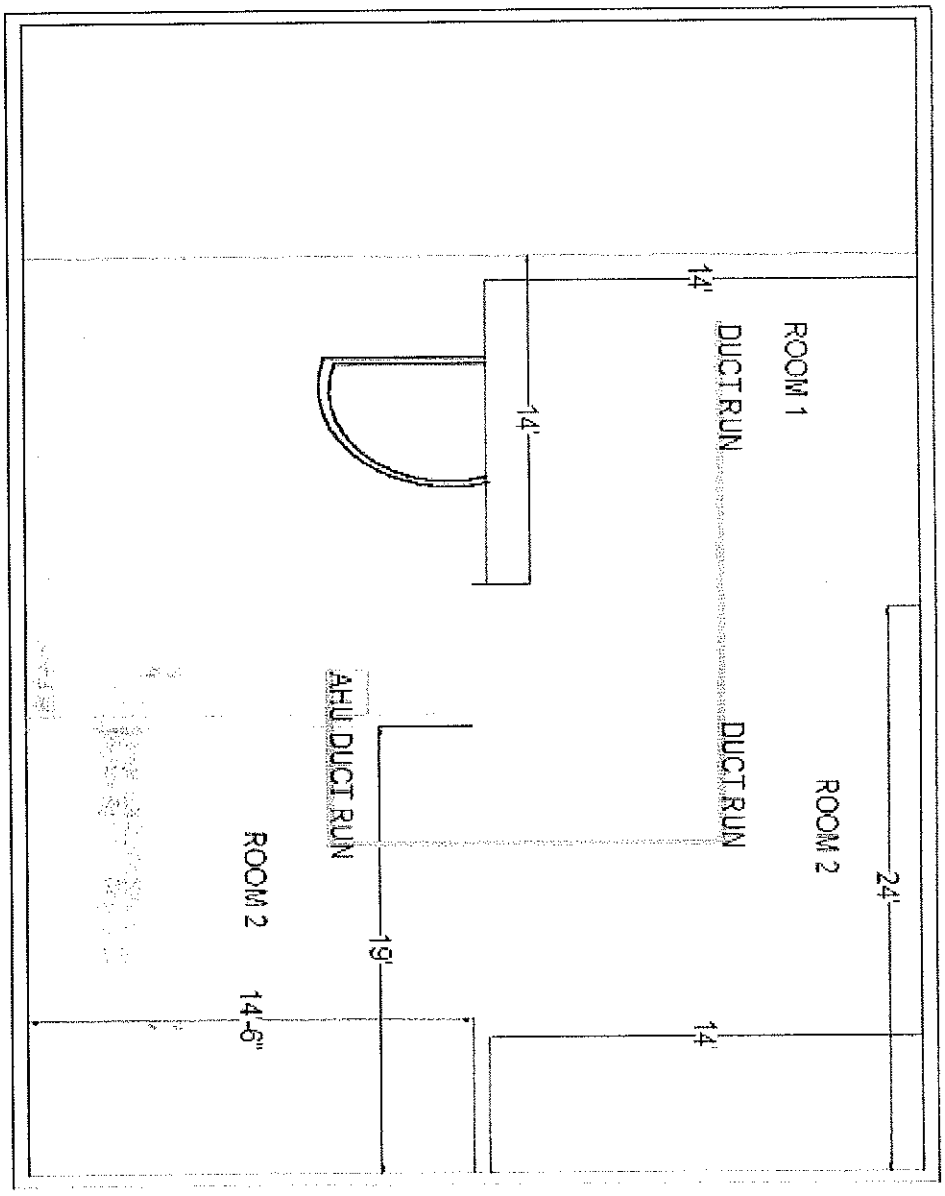

1.CALCULATE CFM FOR ROOM 1,2 AND 3
2.WRITE DUCT DIMENSIONS
3.Make a table and fill in values for blanks

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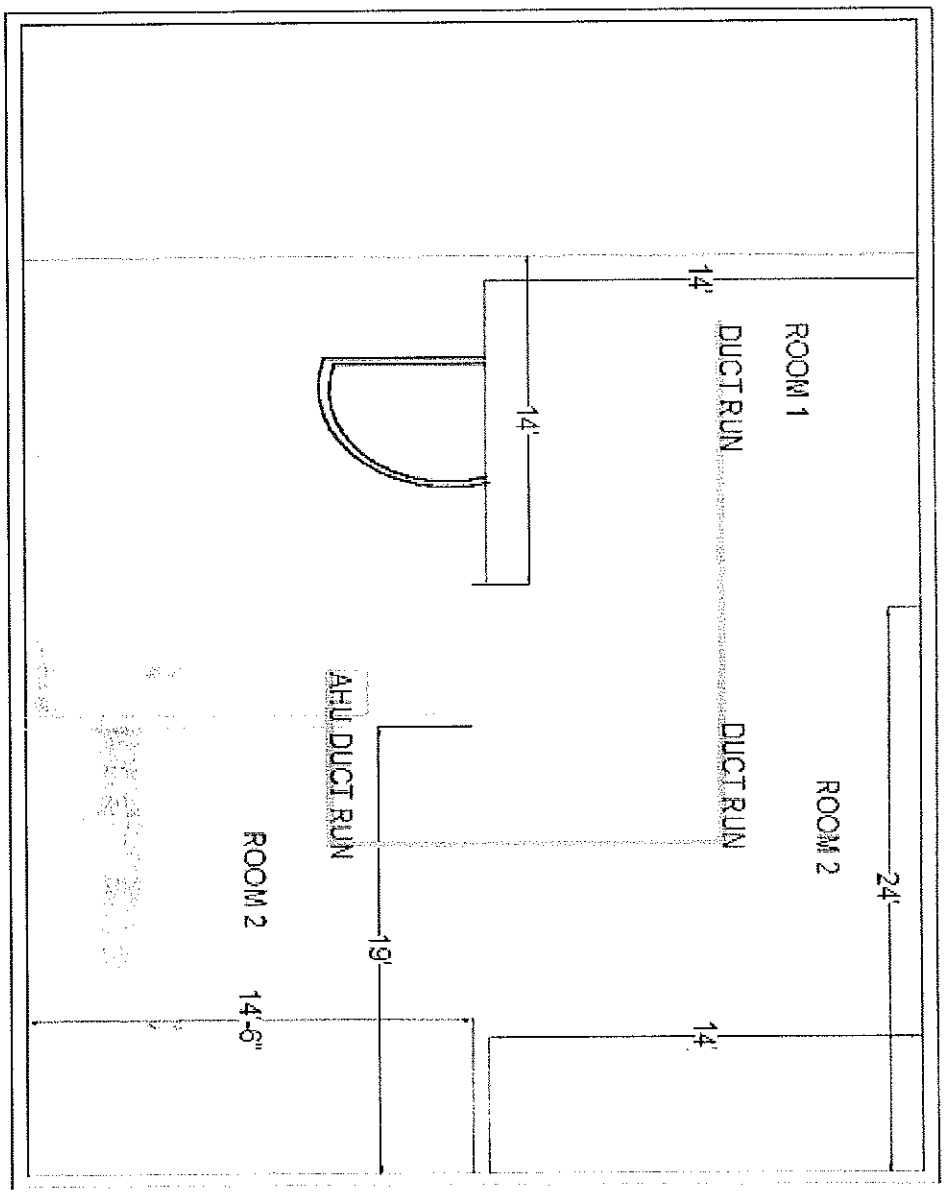
PRODUCED BY AN AUTODESK STUDENT VERSION



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

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Registration No.: .....

School of Refrigeration & Air conditioning Skills

Session: 2021-22 (Summer Semester)

B. Voc. Program, V-Semester,

2nd In-Sem. Examination

Course Code: RAC 1302 Time: 1 Hour

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

Instruction:

1.Read the question carefully, do attempt all 2.Use of calculator is allowed

Section – A

05X01 = 05 Marks

Q1) a. Volume
Q2) a.100
Q3) a. Moist air
Q4) a. Air & water
Q5) d. all the above

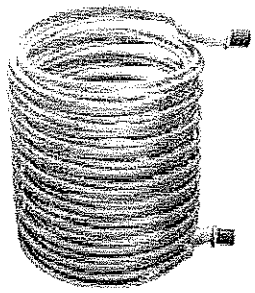
Section – B

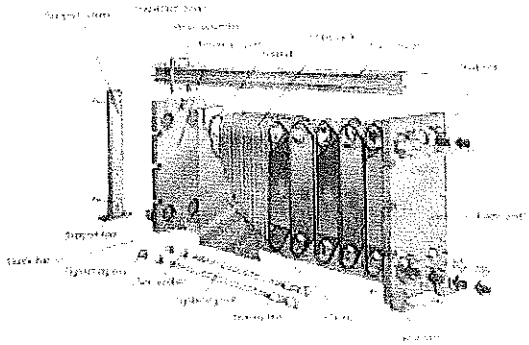
03X02 = 06 Marks

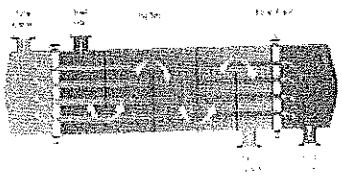
A6) Shell Type-Used where the load is low with space constrain spiral tube in form of coil is shaped to cool the secondary refrigerant

2.Plate heat exchanger type- here two concentric plates are sandwiched between the tube where aluminum plates used as a fin to increase area for heat transfer

3.Flooded shell and tube- here tubes carry refrigerant or secondary refrigerant and as per the application shell part are exposed to these number of tubes for better heat transfer coefficient.







A7) 17 Natural Ventilation

1) single – side ventilation

2) cross flow ventilation

3) stack ventilation

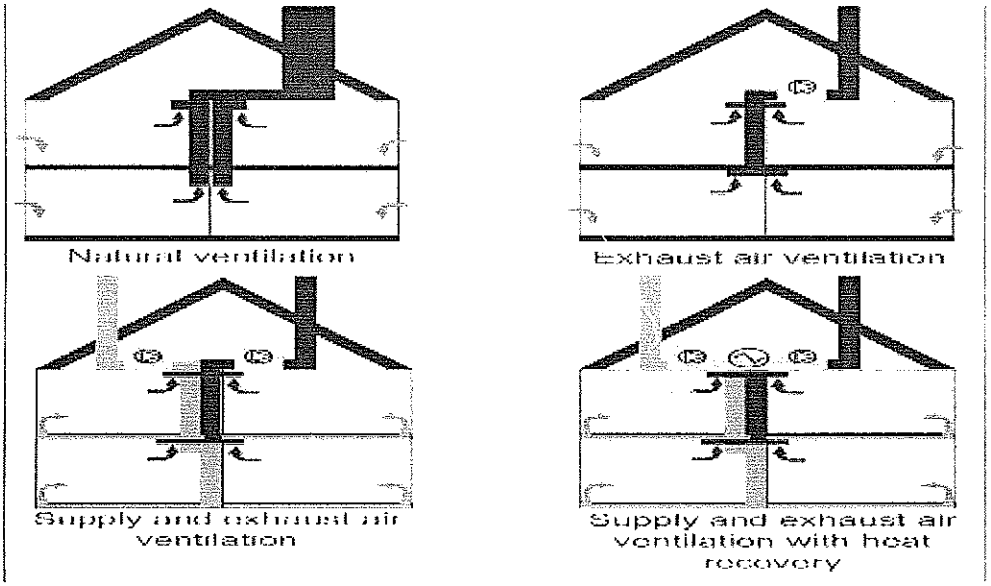
4) Top - down ventilation

Forced ventilation.

1) positive pressure

2) Horizontal Mechanical

3) Hydraulic



A8) Pressure
High pressure duct – above 6(7/8"w.c)
Medium pressure duct 3 (1/4") " of w.c
Low pressure duct 1-3/4" of water column

Section – C

03X03 = 09 Marks

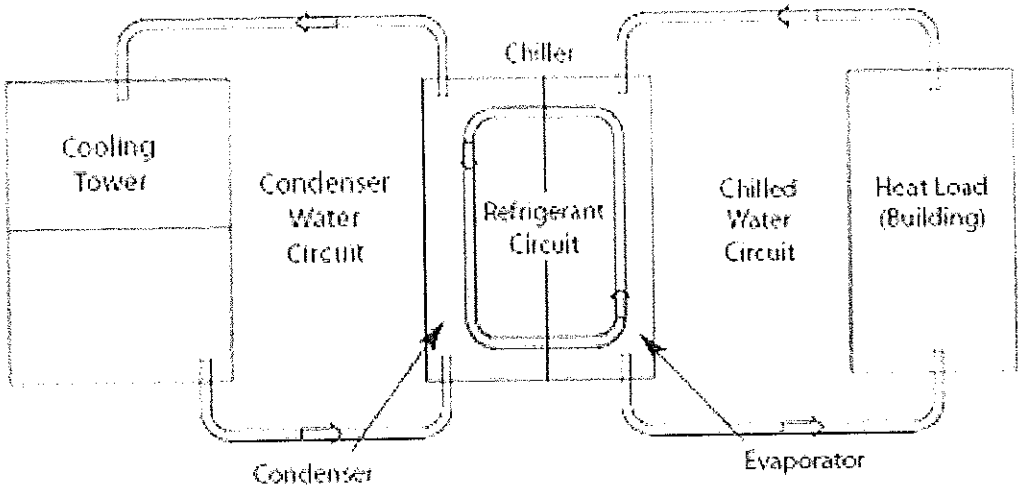
A1)
a. kitchen ventilation- used for air washing and removal of unburnt particle
b. Parking ventilation- used to Remove the parking exhaust smoke and add up fresh air.
c. Industrial Air Ventilation – Are used to remove excess flying sooth and fresh air.

A2) Calculate the required CFM and design the Duct for given building? Height to take 10.'
1) CFM of air required

DUCT	CFM	VELOCITY	PRESSURE AT	Duct size D equivalent	DUCT
A	65.33	400	0.05"	6"	A
A1	112	450	0.05"	6.5"	A1
B	92.46/93	420	0.05"	6"	B

A3)
There are basically three cycle in an chiller
1.Refrigeration cycle
2.Primary cycle
3.Secondary cycle
Refrigeration cycle is the basic cooling cycle used to produce cooling
While water from the evaporator to the building keeps on running in the pipes by pumps is called

Primary pumps -Basically it connects the building load to the chiller.



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School of RAC Skills

III Semester, 2nd In-Sem. Examination

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

Time: 1 Hour

Course Code: RAC1303

Max. Marks: 20

Course Name: RAC Electrical,Electronics & Instrumentation-II

Instruction:

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

Section – A

05X01 = 05 Marks

1. The power rating of CSIR motor lies between :

   a. 120 - 750 W
   b. 130 - 800 W
   c. 140 - 770 W
   d. None of the above

2. The power rating of CSR motor lies between

   a. 110 - 750 W
   b. 100 - 400 W
   c. 130 - 750 W
   d. All of the above

3. Capacitor run motor is also known as

   a. Permanent start capacitor motor
   b. Permanent Shock capacitor motor
   c. Permanent Split capacitor motor
   d. None of the above

4. The power rating of shaded pole motor lies between

   a. 20 – 40 W
   b. 30 – 50 W
   c. 20 – 50 W

d. 20 – 60 W

5. The two main parts of a three phase induction motor is

   a. Rotor
   b. Stator
   c. Windings
   d. Both a & b

Section – B

03X02 = 06 Marks

1. What are two types of electrical connection of a three phase induction motors.
2. Applications of shaded pole motors.
3. Explain the advantage of three phase induction motors.

Section – C

03X03 = 09 Marks

1. Explain the applications of RSIR motors.
2. Explain the schematic diagram of CSIR motor.
3. Explain CSR motors .

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School of RAC Skills

III Semester, 2nd In-Sem. Examination

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

ANSWER KEY

Course Code: RAC1303 Time: 1 Hour

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

Section – A

05X01 = 05 Marks

1. The power rating of CSIR motor lies between :

   a. 120 - 750 W

2. The power rating of CSR motor lies between

   b. 100 - 400 W

3. Capacitor run motor is also known as

   c. Permanent Split capacitor motor

4. The power rating of shaded pole motor lies between

   a. 20 – 40 W

5. The two main parts of a three phase induction motor is

   d. Both a & b

Section – B

03X02 = 06 Marks

1. What are the two types of electrical connection of a three phase induction motors.

   ANSWER: The two types of electrical connection of a three phase induction motors are:-

   1. Star connection
   2. Delta Connection

2. Applications of shaded pole motors.

   ANSWER:

   These motors are only suitable for low power applications e.g., to drive:

   a. small fans

b. Toys

c. Hair driers

d. Desk fans etc.

3. Explain the advantage of three phase induction motors.

ANSWER: Advantages of Three Phase Induction Motor

- It has simple and rugged construction.
- It requires less maintenance.
- It has high efficiency and good power factor.
- It is less expensive.
- It has self-starting torque.

Section – C

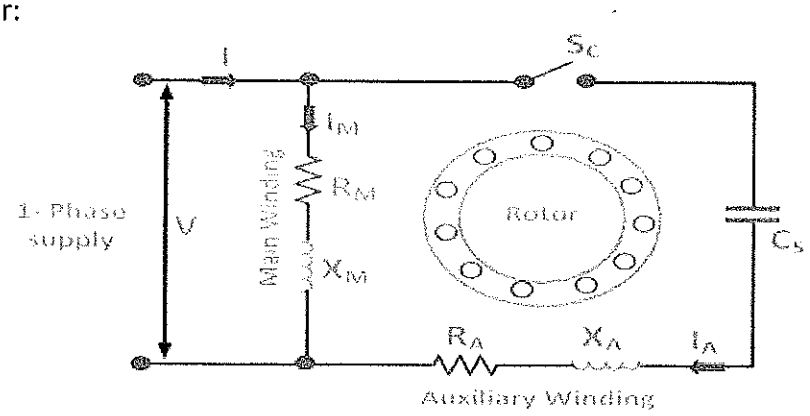
03X03 = 09 Marks

1. Explain the applications of RSIR motors.

Answer : The split-phase induction motor is also known as a resistance-start motor. It consists of a single-cage rotor, and its stator has two windings ? the main winding and a starting (also known as an auxiliary) winding. Both the windings are displaced by 90° in space like the windings in a two-phase induction motor.

2. Write the types of AC motors.

Answer:



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3. Explain CSR motors

Answer:

Application Of Capacitor start and Capacitor run induction motor

Capacitor start capacitor run motors are the most powerful single-phase motors and can be used for quite demanding applications, e .g. high-pressure water pumps and vacuum pumps and other high-torque applications which require 1 .1 to 11 kW.

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School of RAC Skills

III Semester, 2nd In-Sem. Examination

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

Course Code: RAC1304 Time: 1 Hour

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

Instruction:

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

Section – A

05X01 = 05 Marks

1. Convert 2.5 Kw-h into KJ.
   a. 3600
   b. 9000
   c. 5000
   d. None of the above
2. What is the measuring unit of specific heat?
   a. KJ/KgK
   b. KJ/Kg
   c. KJ/S
   d. None of the above
3. Convert 35 Kw into hp.
   a. 1.125
   b. 112.5
   c. 11.25
   d. None of the above
4. The approximate storage temperature of fish is.
   a. 12 °C
   b. -10 °C
   c. -25 °C
   d. 5 °C
5. What will be the reason for no cooling in cold storage system?
   a. Cooling tower fan running fast
   b. Refrigerant is leaking slightly
   c. Lubrication oil level is high
   d. No gas in the system

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Section – B

03X02 = 06 Marks

1. Write down the sources of loads for cold rooms.
2. A cold storage of dimension 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 18 hours daily, find out total transmission load.
3. A cold storage of dimension 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

4. 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).
5. 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.
6. 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. 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/°C. Find out total load.

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School of RAC Skills

III Semester, 2nd In-Sem. Examination

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

Course Code: RAC1304 Time: 1 Hour

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

Instruction:

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

Section – A

05X01 = 05 Marks

1. Convert 2.5 Kw-h into KJ.

   b. 9000

2. What is the measuring unit of specific heat?

   a. KJ/KgK

3. Convert 35 Kw into hp.

   c. 11.25

4. The approximate storage temperature of fish is.

   c. -25 °C

5. What will be the reason for no cooling in cold storage system?

   d. No gas in the system

Section – B

03X02 = 06 Marks

1. Write down the sources of loads for cold rooms.

   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 storage of 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 18 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 18 hours operation = 122.1 *18/24 = 91.5 Kw ans.

3. A cold storage of dimension 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.

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Section – C

03X03 = 09 Marks

4. 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.

5. 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.

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.

6. 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

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.