BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of RAC Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, 5th Semester,

1st In-Sem. Examination

Course Code: HVA-1501 **Time: 1 Hour**

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

Instruction: Attempt all questions

SET-A

Section – A

05X01 = 05 Marks

1. What affects the heat transfer from floor?
    a. Design of the building
    b. Type of insulation
    c. Vapor Barrier
    d. All of the above
2. A person at rest will release approximately:
    a. 300 BTUs
    b. 500 BTUs
    c. 200 BTUs
    d. 100 BTUs
3. Which of the following problems affect a building's envelope?
    a. Wrong calculation
    b. Efflorescence
    c. Stack effect
    d. None of the above
4. Transmission gains depend upon
    a. Type of material
    b. Thickness and thermal conductivity
    c. Area of the material
    d. All of the above
5. What effects the transfer factor of walls?
    a. The vapor barrier
    b. The type of insulation
    c. Both A&B
    d. None of the above

Section – B

03X02 = 06 Marks

6. What are transmission gains?
7. What are the different heat gain variables?

8. What is the difference between exfiltration and infiltration?

Section – C

03X03 = 09 Marks

9. What is a building envelope?
10. What are the main factors that affect infiltration?
11. How do we calculate Conduction heat losses and U-factor?

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Session: 2020-21 (Summer Semester)

B. Voc. Program, 5th Semester,

1st In-Sem. Examination

Course Code: HVA-1501 **Time: 1 Hour**

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

Instruction: Attempt all questions

SET-A AK.

Section – A

05X01 = 05 Marks

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

Section – B

03X02 = 06 Marks

6. Transmission losses is the process of materials in the house having an effect on the heat gain and heat loss. The type of transmission losses are:
    a. Type of material
    b. Thickness and thermal conductivity
    c. Area of the material
    d. Temperature difference between indoors and outdoors
7. A. Ventilation
    a. Lights and fixtures
    b. Appliances
    c. People
8. Exfiltration occurs when bathroom fans in kitchen fans are running an exhausting the inside air to outside. Infiltration is a process of air entering the building through means of replacing their that was exhaust from the building.

Section – C

03X03 = 09 Marks

9. The building envelope is the enclosure, barrier, and separator of the outdoor environment and the desired indoor environment. It is also the protector from the undesired outdoor threats of danger.
10. Infiltration is the process of air coming into the house from the outdoors. There are many factors that can cause infiltration such as windy days, a large temperature difference from indoors and out, and the stack effect. There are two main forces driving infiltration: the prevailing wind and natural draft.

11. The U-factor is more commonly used to describe thermal conductivity in HVACR load calculations

A U-factor is assigned for a material of a given thickness.The smaller the U-factor the lower the conductivity and the higher the R value The rate of heat loss via conduction for a given building panel is calculated by the

formula: Q = U-factor x Area x Δt

$$Q = A\left(\frac{k}{\Delta x}\right)(\Delta T)$$

where:

Q = rate of heat transfer through the material (Btu/hr)
k = thermal conductivity of the material (Btu/°F • hr • ft)
Δx = thickness of the material in the direction of heat flow (ft)
ΔT = temperature difference across the material (°F)
A = area heat flows across (ft^2)

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of RAC Skills

Set - A

V Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2020-21)

Course Code: HVA1502 **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. Keeping in mind that texture changes take place after harvest, pulpy fruits become extremely hard after harvest.

a. True
b. False
c. Mixed
d. None of the above

2 After harvest, _____ of fruits and vegetables undergoes change.

a. Texture, nutrients, minerals
b. Color, minerals, nutrients
c. Texture, minerals, nutrients
d. None of the mentioned

3 Which of the following is true about fruits and vegetable processing?

a. They get spoil very fast and hence need to be consumed soon
b. They have high moisture content and should be kept in a cold, dark place
c. They're tender and hence get spoiled easily
d. All of the mentioned

4 Which of the following is not related to Post Harvest losses?

a. Postharvest losses can be reduced by adding value to products
b. Packaging, storage, transportation areas are where losses take place
c. Farmers don't earn much after adding value to products
d. Value can be added to products by converting raw form into a more processed/refined form

5. Which of the following are Milk Processing Operations?

a. Clarification
b. Pasteurization
c. Homogenization
d. All of the mentioned

Section – B

03X02 = 06 Marks

1. What is the difference between cold storage and cold chain?
2. Write a short note on cold store doors.
3. Write down the different types of cold storages.

Section – C

03X03 = 09 Marks

1. Explain postharvest physiology of fruits and vegetables through neat sketch.
2. Write down the pre harvesting factors that affect the product quality.
3. Explain different types of insulation in detail.

Najmul Haque

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of RAC Skills

Set - A

V Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2020-21)

ANSWER KEY

Course Code: HVA1502 Time: 1 Hour

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

Section – A

05X01 = 05 Marks

1. Keeping in mind that texture changes take place after harvest, pulpy fruits become extremely hard after harvest.

b. False

2 After harvest, _____ of fruits and vegetables undergoes change.

a. Texture, nutrients, minerals

3 Which of the following is true about fruits and vegetable processing?

d. All of the mentioned

4 Which of the following is not related to Post Harvest losses?

c. Farmers don't earn much after adding value to products

5. Which of the following are Milk Processing Operations?

d. All of the mentioned

Section – B

03X02 = 06 Marks

1. What is the difference between cold storage and cold chain?

A cold chain warehouse (or cold chain storage) is a specialized structure that's always closed off and insulated from its external environment, and where conditions inside are carefully controlled. Cold chain warehouses (often referred to as ""cold storage"" or ""temperature controlled warehouses"") are used to store perishables that are extremely sensitive and can spoil easily if not stored properly. Transportation in cold chains is carried out in cold boxes or refrigerated containers that accomplish EXACTLY what a cold chain warehouse's facilities do - guarantee that temperature-sensitive goods are maintained in conditions that guarantee their survival, whether in the warehouse or on the road.

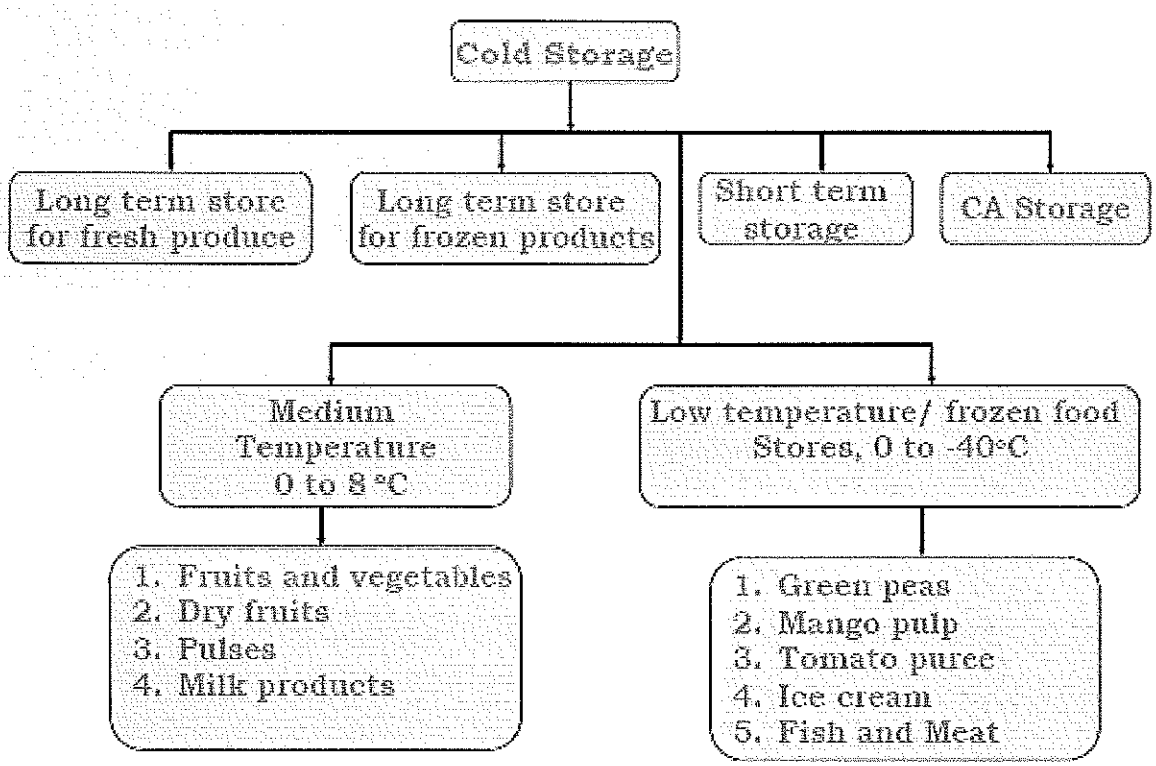
A cool store or cold store is a large refrigerated room or building designed for storage of goods in an environment below the outdoor temperature. Products needing refrigeration include fruit, vegetables, seafood and meat. Cold stores are often located near shipping ports used for import/export of produce.

2. Write a short note on cold store doors.

When choosing a door system the following should be considered

- Is the track designed to give a good positive sealing action without undue wear to the sealing gaskets and will it be strong enough for its usage?
- Does it allow the door to be adjusted easily and accurately in all directions?
- Are the runners durable and will they allow free running?
- Will the handles, both inside and outside, allow easy opening of the door?
- Can the system be locked and does it have an emergency release facility?
- Do the moving parts require little maintenance and can they be easily replaced in the event of damage?

3. Write down the different types of cold storages.



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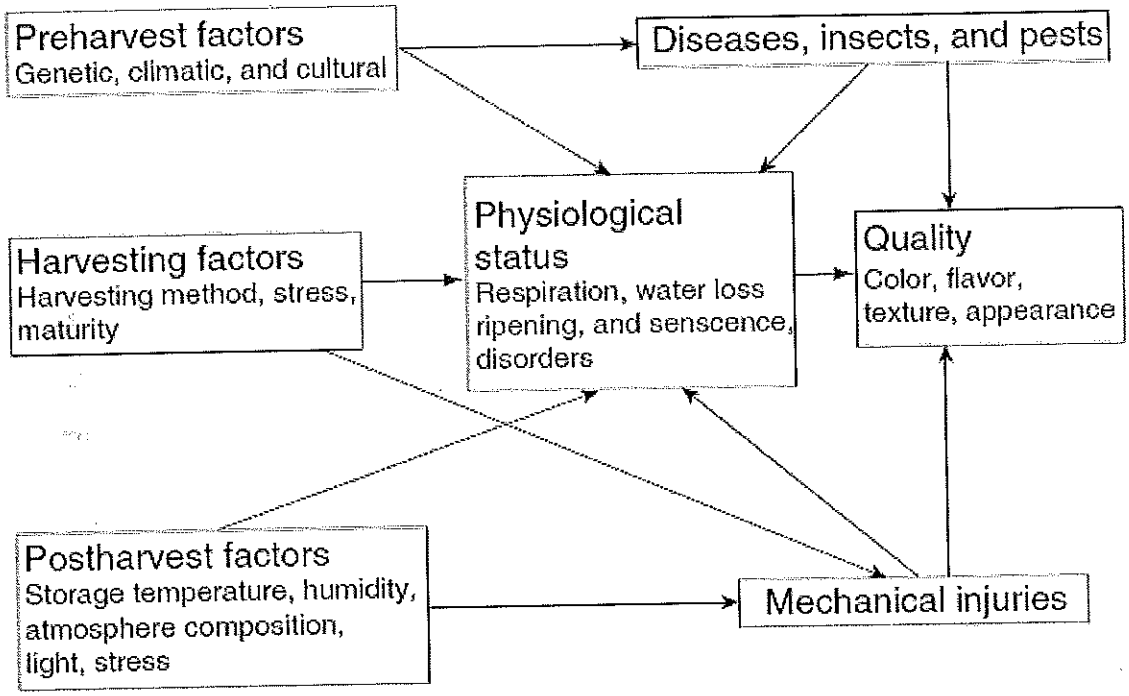
Section – C

03X03 = 09 Marks

1. Explain postharvest physiology of fruits and vegetables through neat sketch.



2. Write down the pre harvesting factors that affect the product quality.

Answer: Genetic

Genetic makeup has a profound effect on the selection of a raw material for a given processing application. Cultivar and rootstock selection influence the composition, quality, storage potential, and response to processing characteristics that may be inherited.

Climatic

The growing region and environmental conditions specific to each region, such as temperature, humidity, light, wind, soil texture, elevation, and rainfall, significantly influence the quality of fruits and vegetables.

Cultural Practices

Soil type, soil nutrient and water supply, pruning, thinning, pest control or chemical spray, and density of planting influence the quality of plant produce.

3. Explain different types of insulation in detail.

Expanded polystyrene

Expanded polystyrene (EPS) is one of the most efficient rigid insulation materials available today and is widely and successfully used throughout the cold store industry.

Extruded polystyrene

Extruded polystyrene is basically manufactured from the same raw material as EPS, with the exception that extruded polystyrene for use in panel production is a foam insulation board without a skin. Other forms of extruded polystyrene are available, incorporating a skin, such as the heavier density used for floor insulation purposes. It is manufactured by a continuous

extruding process which gives a rigid closed cell structure with unique properties.

Polyurethane

Rigid polyurethane (PUR) foams are highly cross-linked polymers with closed cell structures which bubble within the material, with unbroken walls, so that gas movement is retarded. The chlorofluoromethane gas is contained within the walls and, as these substances have a much lower thermal conductivity than air, such closed cell forms have significantly lower thermal conductivity than any open cell foam.

Nejmool Haque

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration and Air-conditioning Skills

Session: 2020-21 (Summer Semester)

Set A

B. Voc. Program, V Semester,

1st In-Sem. Examination

Course Code: HVA1503 **Time: 1 Hour**

Course Name: Chilled water supply system design **Max. Marks: 20**

Section – A

05X01 = 05 Marks

Note: Each question carries 02 mark.

Q. 1: In aqua-ammonia and Li-Br water absorption refrigeration system, the absorbents are respectively

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

Q. 2: A refrigerant compressor is used to

A. raise the pressure of the refrigerant
B. raise the temperature of refrigerant
C. circulate the refrigerant through the system
D. all of the above

Q. 3: The natural convection air-cooled condensers are used in

A. domestic refrigerators
B. water coolers
C. room air conditioners
D. all of these

Q. 4: Which compressors used in chillers typically range from 5 to 50 tons.

A. reciprocating
B. scroll
C. screw
D. centrifugal

Q. 5: The commonly used refrigerant in ice plant is

A. NH_3
B. CO_2
C. R-12
D. none of these

Section – B

03X02 = 06 Marks

Note: Each question carries 02 mark.

Q. 1: What is the purpose of an oil-return system for a chiller?

Q. 2: Classified the HVAC chiller.

Q. 3: What is the function of a purge recovery unit?

Section – C

03X03 = 09 Marks

Note: Each question carries 03 mark.

Q. 1: Explain the three loops of water-cooled HVAC system with neat sketch.

Q. 2: Write down the advantages and disadvantages of vapour absorption refrigeration system over vapour compression refrigeration system.

Q. 3: Discuss screw compressor and its types.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

Set. A

AK

School of Refrigeration and Air-conditioning Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, V Semester,

1st In-Sem. Examination

Course Code: HVA1503 **Time: 1 Hour**

Course Name: Chilled water supply system design **Max. Marks: 20**

Section – A

05X01 = 05 Marks

05 objective type questions, each question carries 01 mark.

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

Section – B

03X02 = 06 Marks

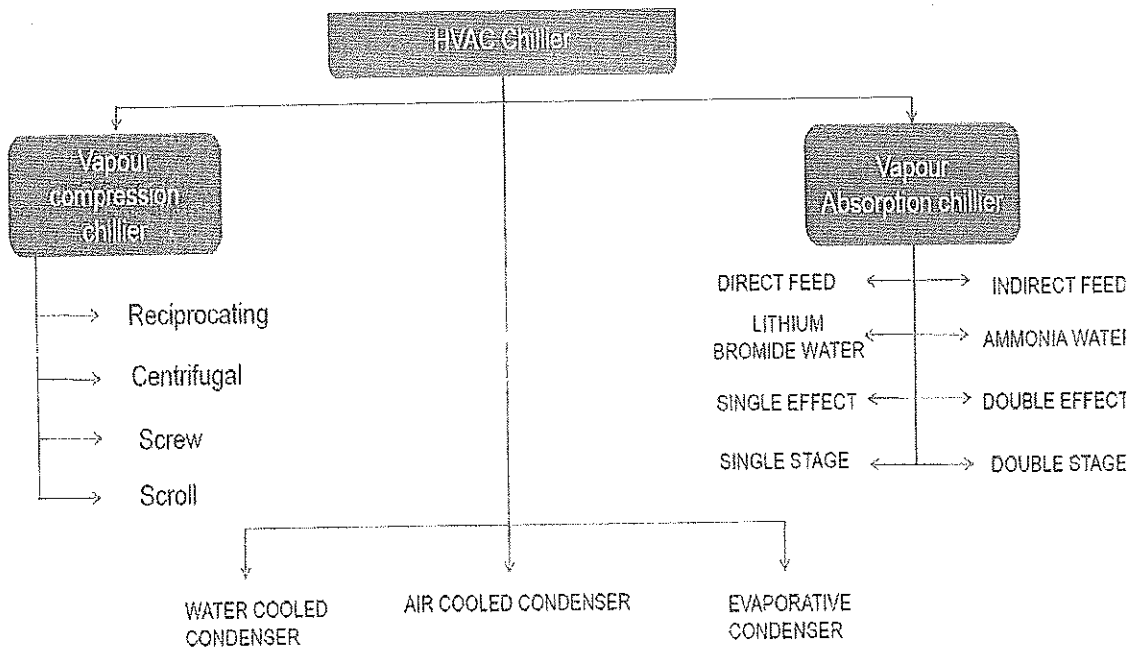
3 short answer type questions, each question carries 02 marks.

Q. 1: What is the purpose of an oil-return system for a chiller?

Ans. An oil pump can reduce the minimum lift to about 5.5°C, resulting in improved chiller efficiencies at low condenser water temperatures, particularly with variable- speed chillers.

Q. 2: Classified the HVAC chiller.

Ans.



Q. 3: What is the function of a purge recovery unit?

Ans. Centrifugal chillers that use low-pressure refrigerants such as R-123 operate below atmospheric pressure. When they leak, air and moisture are drawn into the machine. Purge units remove the non-condensable gases that collect in the condenser during normal operation and ultimately reduce the heat transfer effectiveness, causing greater refrigerant head pressures.

Section – C

03X03 = 09 Marks

03 essay type questions, each question carries 03 marks.

Q. 1: Explain the three loops of water-cooled HVAC system with neat sketch.

Ans.

- Loop 1: Air system: Cold air is distributed by one or more air-handling units (AHUs) to the spaces within the building. The distributed air is returned to the air handling unit, mixed with the required quantity of outdoor air for ventilation.
- Loop 2: Chilled water system: The warmer-returned chilled water enters the water chiller where it is cooled to the desired chilled water supply temperature by transferring the heat extracted from the building spaces to a primary refrigerant.
- Loop 3: Condenser water system: The heat of compression must then be added to the heat load on the chilled water loop to establish the amount of heat that must be rejected by the condenser to a heat sink, typically the outdoor air.

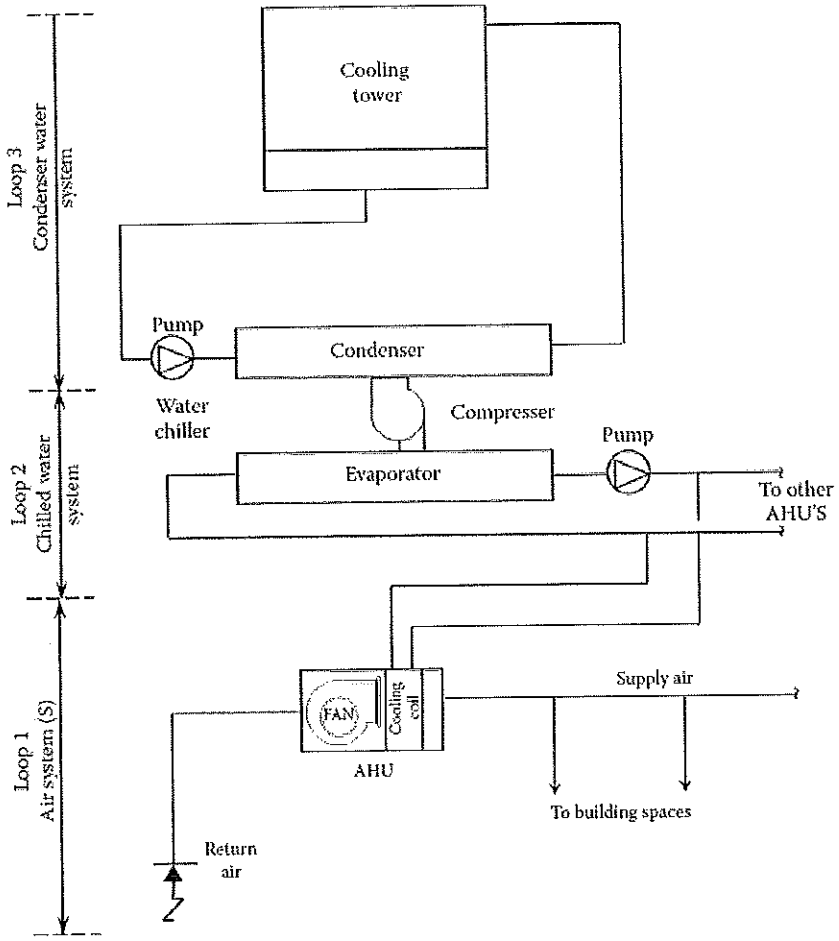


Fig. Water-cooled HVAC system

Q. 2: Write down the advantages and disadvantages of vapour absorption refrigeration system over vapour compression refrigeration system.

Ans.

Advantages of VARS over VCRC

1. In the VARS, the only moving part of the entire system is a pump which has a small motor. Thus, the operation of this system is essentially quiet and is subjected to little wear. The vapour compression system of the same capacity has more wear, tear and noise due to moving parts of the compressor.
2. VARS system uses heat energy to change the condition of refrigerant from the evaporator. The VCRC system uses mechanical energy to change the condition of refrigerant from the refrigerant.
3. The VARS system are usually designed to use steam, either at high pressure or low pressure. The exhaust heat from furnaces and solar energy may also be used. Thus, this system can be used where the electric power is difficult to obtain or is very expensive.

4. The space requirements and automatic control requirements favor the absorption system more and more as the desired evaporator pressure drops.
5. The VARS system can be built in capacities well above 1000 tons of refrigeration each, which is the largest size for single compressor units.
6. The load variations do not affect the performance of VARS system. The performance of a vapour compression system at partial loads is poor.
7. In the VARS system, the liquid refrigerant leaving the evaporator has no bad effect on the system except that of reducing the refrigerating effect. In the VCRC system, it is essential to superheat the vapour refrigerant leaving the evaporator so that no liquid may enter the compressor.

Disadvantage:

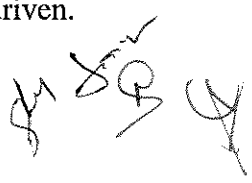
1. Less COP
2. More space required
3. More amount of refrigerant is circulated, which increase the running cost.

Q. 3: Discuss screw compressor and its types?

Ans. Screw chillers tend to be most cost competitive in the 100 to 300-ton range, although they are available in a wider range of capacities. Rotary screw chillers are also positive displacement machines. Like scroll chillers, they are particularly suitable as air-cooled chillers but are popular in both air- and water-cooled configurations. Screw chillers are inherently more efficient than scroll compressors because they incorporate refrigerant economizers. Screw chillers tend to be noisy at design conditions due to the high speed of operation. Screw compressors utilize double-mating helically grooved rotors with "male" lobes and "female" flutes or gullies within a stationary housing.

Types of screw compressor

1. Single screw: The single screw consists of a single cylindrical main rotor that works with a pair of gate rotors. The compressor is driven through the main rotor shaft, and the gate rotors, followed by direct meshing action.
2. Twin screw: The twin screw is also known as a double helical rotary screw. The twin screw consists of two mating helically grooved rotors, one male and the other female. Either the male or female rotor can be driven.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of RAC **Skills**

Session: 2020-21 (Summer Semester)

B. Voc. / M. Voc. Program, _____ Semester,

1st In-Sem. Examination

Course Code: HVA1504 **Time: 1 Hour**

Course Name: AC systems & Testing **Max. Marks: 20**

Instruction: (if any)

Set - A

Section – A

05X01 = 05 Marks Answer key

Section A

Answer 1) Nacph -Number of air change per hour.

Exchange of full room volume air to maintain the ventilation. Moreover, an oxygen level in the room air

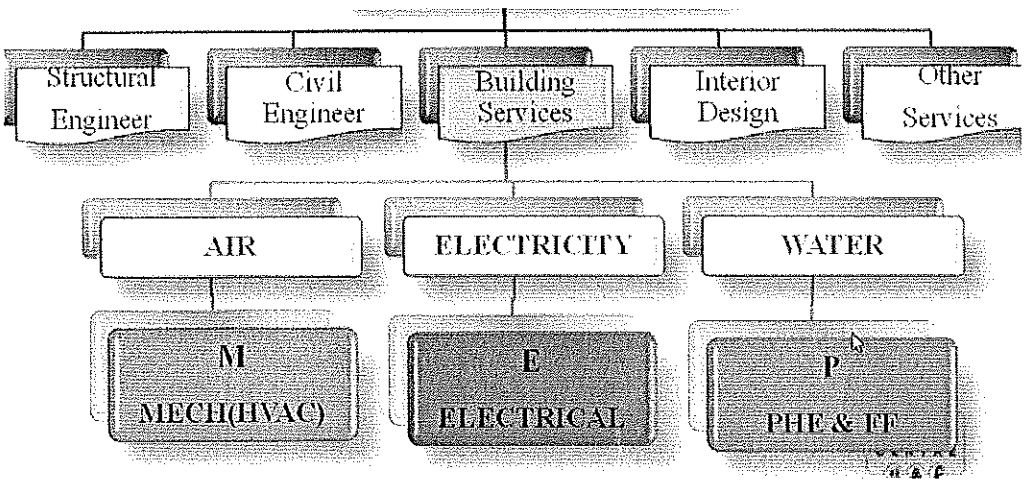
ANSWER 2) (A)SATURATED Liquid

Answer3) (A)Under writer's laboratory
Answer4) (A)Sheet Metal Specification (GI).

Answer5)a) Leadership in Energy and Environmental Design

Answer 2.1) Process of removal of foul air by adding fresh air.
Parking Ventilation
Kitchen Ventilation
For parking area, volume of that particular area is considered for CFM Methods of Ventilation in Parking Area ,Using Jet Fans, Using Blower in Ducting

Answer2.2)



Answer 2.3) Answer 2)3)

1)36 sq ft = 6*6 ft =72" *72"

2)144sq inches =12" *12"

Section c

Answer 3.)1)a) Number of sheets required

b) Weight of duct take density =7.85 kg/m^2

1. 20" × 20" ×10"

STEP1) = SURFACE AREA = 2(L+B)*H =2(20+20)*10=800"SQ.INCH

1)Using sheet of 8*3=3456sq inch we have =800/3456=0.23 sheet =1 sheet

2)weight of duct =density *thickness of sheet *area

=7.85*.65*800=4082kg

Answer 3.2) Duct shapes Round ,square, flat oval shape

According to Duct velocity

1. Low – up to 1500 FPM
2. Medium -1500-2500 FPM
3. High 2500-4500 FPM

Answer 2.3)

1) CFM of air required

2) Line diagram for duct design using EFM

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

Answer 3)

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

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration & Air conditioning Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, V-Semester,

1st In-Sem. Examination

Course Code: RAC 1504 HVA

Time: 1 Hour

Course Name: AC system & Testing

Max. Marks: 20

Instruction:

1.Use the attached chart for reference.

2.Take given dimensions in Inches or convert them.

Set-A

Section – A

05X01 = 05 Marks

Q1.) What is Nacph

A. Number of air change per hour
B. Number of air condensed per hour
C. Number of person cfm per hour
D. Number of air cumulated per hour

Q2) The condition of refrigerant after passing through the condenser in a vapour compression system is

(A) Saturated liquid
(B) Wet vapour
(C) Dry saturated vapour
(D) Superheated vapour

Q3) Fire dampers are certified by

(A)Under writer's laboratory
(B)Ashrae
(C)Ishrae
(D)Duct work

Q4) BIS-277 is for _____

(A)Sheet Metal Specification (GI).

(B)BIS-655 Sheet Metal Fabrication and Erection Installation (GI).

(C) Sheet Metal Work Safety Standards.

(D) DUCT WORK

Q5) LEED stands for

A. Environment
B. Duct design
C. Duct working codes
D. Manufacturing and installation of air units

Section – B

03X02 = 06 Marks

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

Question1) What is ventilation?

Question2) Draw the flow chart for building survey/Project?

Question3) Using the continuity equation calculate the sizes of duct?

1)36 sq ft 2)144sq inches

Section – C

03X03 = 09 Marks

03) essay type questions, each question carries 03 marks.

Q1) For the given dimension of duct find

a) Number of sheets required

b) Weight of duct take density =7.85 kg/m²

1. 20" × 20" ×10"

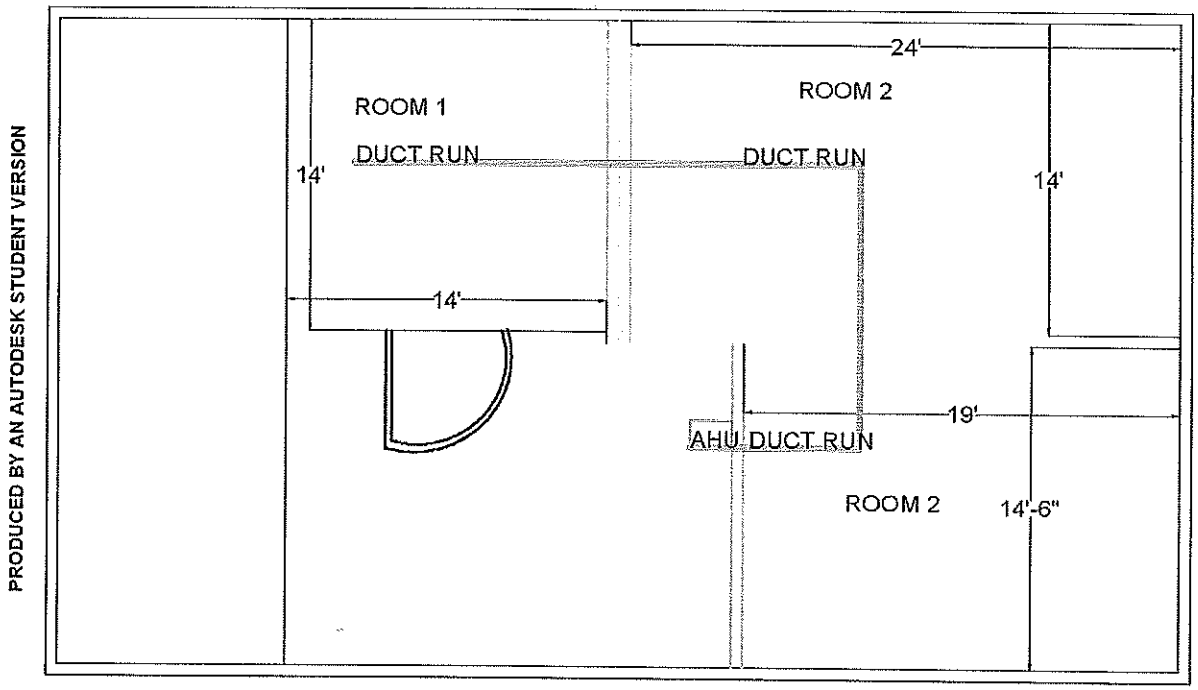
Q2) Calculate the required CFM and design the Duct for given building? Height to take 10'

1) CFM of air required

2) Line diagram for duct design using EFM

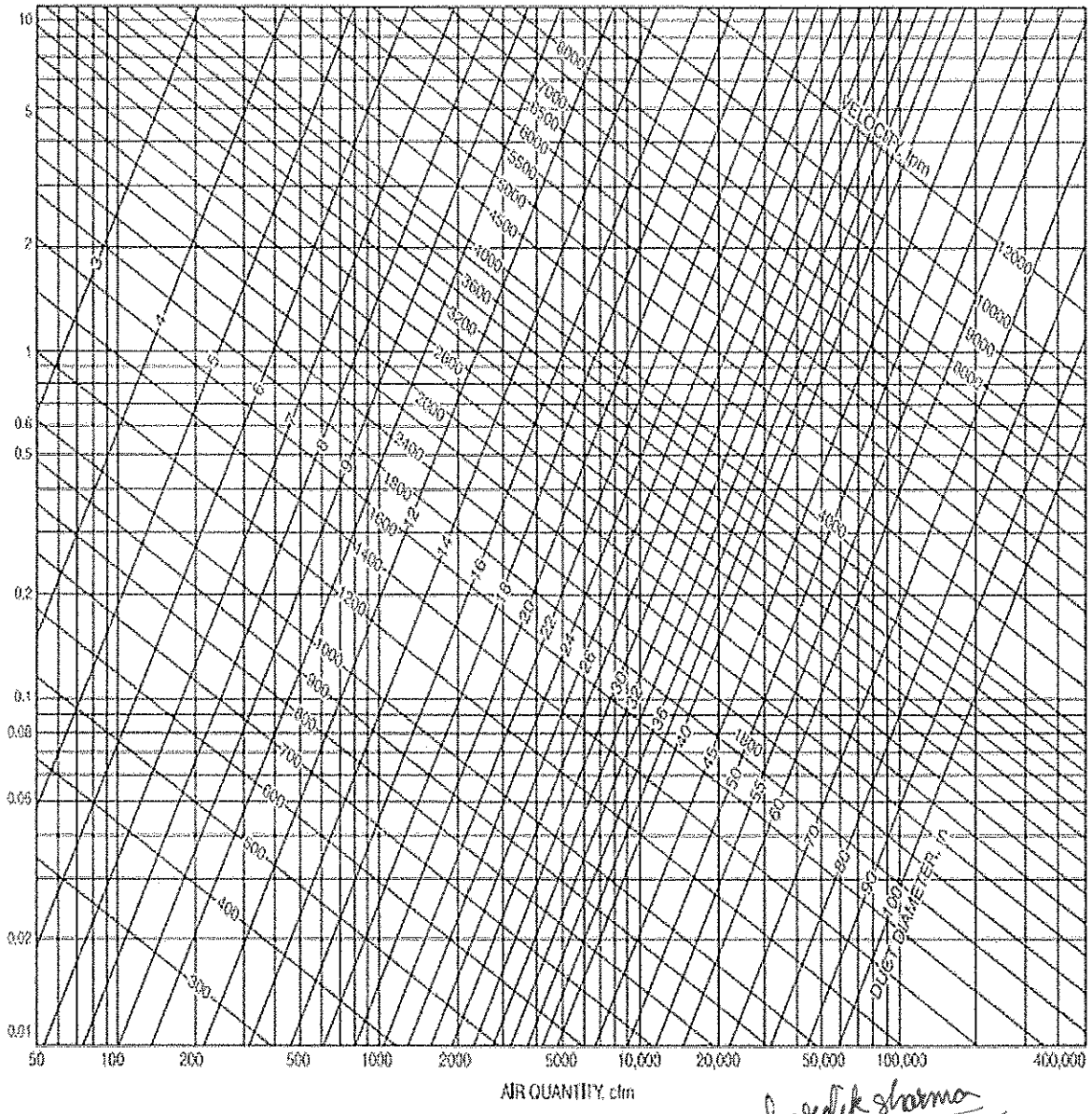
) Line diagram for duct design using EFM

DUCT	CFM	VELOCITY	PRESSURE AT	Duct size D equivalent
Room 1		400	0.05"	
Room 2		450	0.05"	
Room 3		420	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

Q3) Define types of ventilation?



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 0.003 ft.