



## School of Refrigeration & Air Conditioning

Session: 2020-21 (Summer Semester)

B. Voc., I Semester,

End-Sem. Examination

Course Code: RAC1101

*Set A*

Time: 2 Hours

Course Name: Basic of Refrigeration & Air-conditioning

Max. Marks: 50

Instruction: Read the questions Carefully

Do, mention the Units Also, where Required.

### Section – A

10X01 = 10 Marks

Q.1) The temperature at which substance change its phase Vapor to liquid or liquid to vapor is known as \_\_\_\_\_?

- a) Specific Heat
- b) Sensible Heat
- c) Latent Heat
- d) saturation

Q.2) State of the Refrigerant at Inlet of Evaporator is \_\_\_\_\_

- a) Liquid
- b) Liquid and vapor
- c) Vapor
- d) Solid

Q.3) At Temperature \_\_\_\_\_ & \_\_\_\_\_ a substance can be both Liquid and vapor?

- a) Condensation & Freezing point
- b) Condensing & Boiling point
- c) Freezing & Evaporation Point
- d) Critical point

Q4) Boiling point is a point when \_\_\_\_\_ Pressure of liquid equal to \_\_\_\_\_ pressure?

- a) Liquid & atmospheric
- b) Static pressure & Atmospheric
- c) Vapor & Atmospheric
- d) None of the above

Q5) With Increase in temperature Pressure \_\_\_\_\_?

- a) Decrease
- b) Becomes Super critical
- c) Equal to Saturation
- d) Increases

Q.6) Thermometer is based on which law of thermodynamics \_\_\_\_\_?

- a) Zeroth
- b) First
- c) Second
- d) Third



Q.7) In One inch how many Millimeters?

- a) 25.4mm
- b) 2.54cm
- c) 250cm
- d) 0.25cm

Q.8) Convert 0 degree Celsius into Fahrenheit:

- a) 212
- b) 32
- c) 21.2
- d) 0.21

Q.9) What is the units of density?

- a) Kg/m<sup>3</sup>
- b) m<sup>3</sup>/s
- c) m<sup>3</sup>/kg
- d) T

Q.10) How many Fundamental units are there?

- a) 5
- b) 6
- c) 7
- d) 8

**Section – B**

04X04 = 16 Marks

04 short answer type questions, each question carries 04 marks.

Q.11) Define Zeroth Law & draw a neat sketch explaining the law?

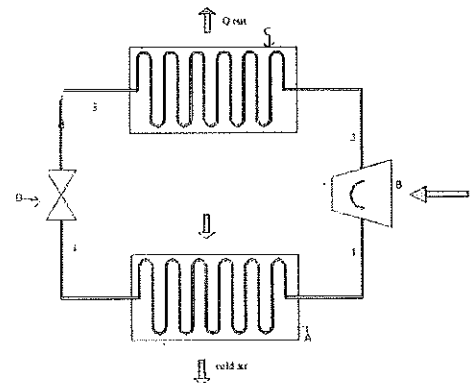
Q.12) What is the difference between Point and Path function?

Q.13) Convert the following

- a) Temperature 20 degree Celsius to \_\_\_\_\_ Rankine.
- b) Length 100 ft to \_\_\_\_\_ Inches.
- c) Mass of 2.2 kg to \_\_\_\_\_ Gram.
- d) Time 10 days to \_\_\_\_\_ Hours.

Q.14) Based on the diagram below Complete the table.

Sr. No	Component Name	State of Refrigerant
1	A-	
2	B-	
3	C-	
4	D-	





# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

## Section – C

04X06 = 24 Marks

04 long type questions, each question carries 06 marks.

Q.15) Define All the three Types of Heat Transfer with a suitable example.

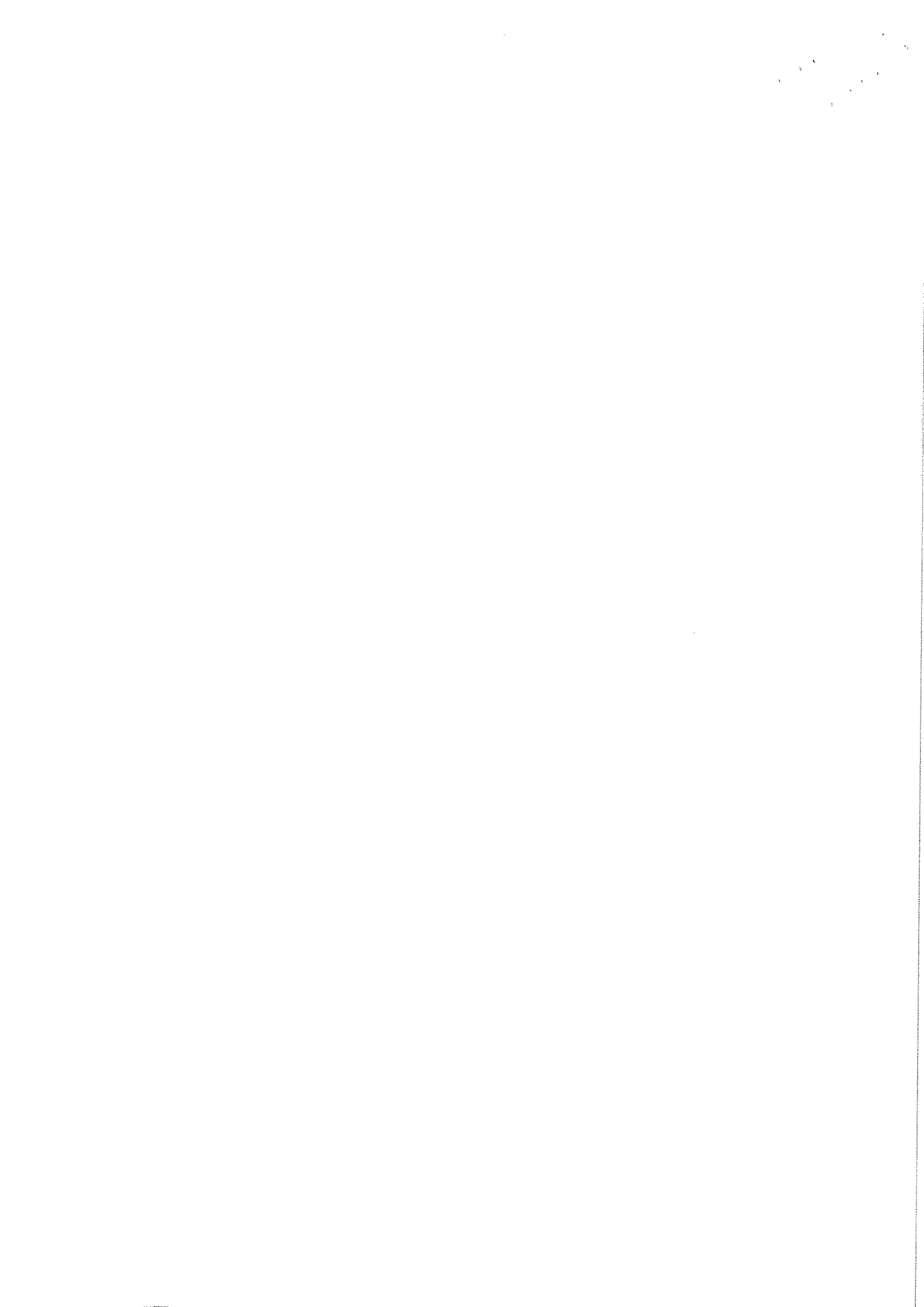
Q.16) What is system, write its types also draw a neat picture (sketch)?

Q.17) Derive the Fundamental unit of the following physical Quantity?

- a) Displacement      b) Force
- c) Velocity            d) Acceleration

Q.18) What is fluid? What are its types of flow?

*Hyderabadiksharma*  
*Bugh*  
*A*





School of Refrigeration & Air Conditioning

Session: 2020-21 (Summer Semester)

B. Voc., I Semester,  
End-Sem. Examination

*Answer Key*

Course Code: RAC 1101

Time: 2 Hours

Course Name: Basic of Refrigeration & Air-conditioning

Max. Marks: 50

Instruction: Read the questions Carefully

Do, mention the Units Also, where Required.

Section – A

10X01 = 10 Marks

10 objective type questions, each question carries 01 mark.

A.1) The temperature at which substance change its phase Vapor to liquid or liquid to vapor is known as \_\_\_\_\_?

d) saturation

A.2) State of the Refrigerant at Inlet of Evaporator is \_\_\_\_\_

a) Liquid

A.3) At Temperature \_\_\_\_\_ & \_\_\_\_\_ a substance can be both Liquid and vapor?

b) Condensing & Boiling point

A.4) Boiling point is a point when \_\_\_\_\_ Pressure of liquid equal to \_\_\_\_\_ pressure?

c) Vapor & Atmospheric

A.5) With Increase in temperature Pressure \_\_\_\_\_?

d) Increases

A.6) Thermometer is based on which law of thermodynamics \_\_\_\_\_?

a) Zeroth

A.7) In One inch how many Millimeters?

a) 25.4mm



A.8) Convert 0 degree Celsius into Fahrenheit:

b)32

A.9) What is the units of density?

a) Kg/m<sup>3</sup>

A.10) How many Fundamental units are there?

c) 7

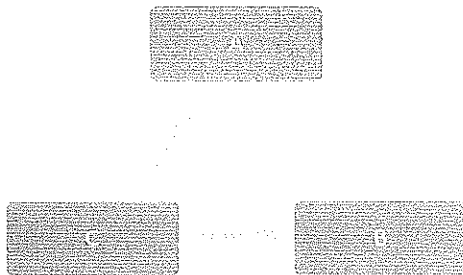
**Section – B**

04X04 = 16 Marks

04 short answer type questions, each question carries 04 marks.

Q.11) Define Zeroth Law & draw a neat sketch explaining the law?

A.11) When a body A is in thermal equilibrium with a body B and separately with a body C, then B and C will be in thermal equilibrium with each other.



where c is a thermometer which measures

the average kinetic intensity of vibration.

Q.12) What is the difference between Point and Path function?

A12)

Point	Path
1. They do not depend on the path followed during a process.	1. They depend on the path and not on the initial and final points.
2. Only depends on initial and final points.	2. Depends on path
3. e.g., temperature, volume, pressure, etc.	3. e.g., work, heat etc.

A.13) Convert the following

a) Temperature 20 degree Celsius to 527.67 Rankine.

b) Length 100 ft to 1200 Inches.



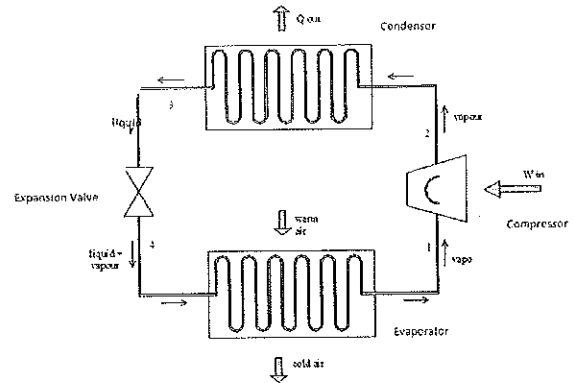
# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

c) Mass of 2.2 kg to 2200 Gram.

d) Time 10 days to 240 Hours.

A.14) Based on the diagram below Complete the table.

Sr. No	Component Name	State of Refrigerant
1	A-Evaporator	Liquid, l & Gas
2	B-Condenser	Vapour
3	C-condenser	Vapour to gas
4	D-Throttling	High pressure liquid



## Section – C

04X06 = 24

Marks

04 long type questions, each question carries 06 marks.

Q.15) Define All the three Types of Heat Transfer with a suitable example.

A.15) Heat can be transferred in three different ways: conduction, convection, and radiation.

1. **Conduction**-refers to the transport of energy in a medium due to a temperature gradient. E.g., Heating of a long rod on flame
2. **Convection**- is the mode of energy transfer between a solid surface and the adjacent liquid or gas that is in motion, and it involves the combined effects of *conduction* and *fluid motion*. E.g.,
3. **Radiation**. - is the energy emitted by matter in the form of electromagnetic waves because of the changes in the electronic configurations of the atoms or molecules

Q.16) What is System, write its types also draw a neat picture (sketch)?

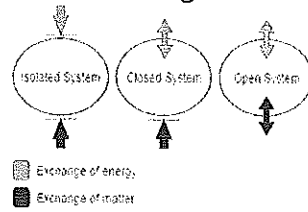
A16.) A System is an object or body under Investigation or study Separated by a physical boundary from the surrounding.

- i. Open- There is interaction of energy and mass both.
- ii. Closed- There is interaction of energy but not the surrounding.



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

iii. Isolated- There is neither interaction of energy nor mass of the surrounding.



Q.17) Derive the Quantity?

Fundamental unit of the following physical

- a) Displacement      b) Force
- c) Velocity            d) Acceleration

Displacement-Displacement = Length

$$[M^0L^1T^0] = \text{Meter}$$

b) Force= mass \* acceleration

$$[M^1L^2T^{-2}] = \text{Kg} \cdot \text{m}^2 \text{ newton} \text{ Sec}^2$$

c) Velocity

$$\text{LENGTH} = [M^0L^1T^{-1}] \text{ METRE/SEC}$$

TIME

d) Acceleration =  $[M^0L^1T^{-2}]$  METRE /SEC<sup>2</sup>

Q.18) What is fluid? What are its types of flow?

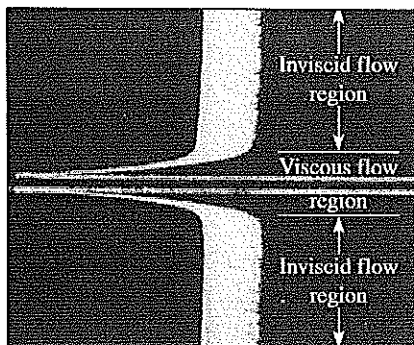
A.18) **Fluid:** A substance in the liquid or gas phase.

A solid can resist an applied shear stress by deforming.

Types of flow

**Viscous flows:** Flows in which the frictional effects are significant.

**Inviscid flow regions:** In many flows of practical interest, there are *regions* (typically regions not close to solid surfaces) where viscous forces are negligibly small compared to inertial or pressure forces.



*by Hardeep Sharma*  
*Diya*



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration & Air Conditioning

Session: 2020-21 (Summer Semester)

B. Voc., I Semester,

End-Sem. Examination

*Set B*

Course Code: RAC1101

Course Name: Basic of Refrigeration & Air-conditioning

Time: 2 Hours

Max. Marks: 50

Instruction: Read the questions Carefully

Do, mention the Units Also, where Required.

### Section – A

10X01 = 10 Marks

10 objective type questions, each question carries 01 mark.

- Q.1) A body named \_\_\_\_\_ is setup for international acceptance in English?
- a) Conference for SI
  - b) General conference in weights and measures
  - c) General unit
  - d) Unit and measures International.

- Q.2) Components of Units are
- a) Numerical value and unit
  - b) Digits and unit
  - c) Magnitude and Unit
  - d) a & c options

- Q.3) How many Fundamental units are there?
- a) 5
  - b) 6
  - c) 7
  - d) 8

- Q4) Kilo has Power of \_\_\_\_\_
- a)  $10^3$
  - b)  $10^{14}$
  - c)  $10^9$
  - d)  $10^{34}$

- Q5) System and surrounding are separated by \_\_\_\_\_?
- a) Boundary
  - b) Fence
  - c) Power
  - d) Border

- Q.6) Thermometer is based on which law of thermodynamics \_\_\_\_\_?
- e) Zeroth
  - f) First
  - g) Second
  - h) Third



Q.7) In One inch how many Centimeters?

- a) 25.4mm
- b) 2.54cm
- c) 250cm
- d) 0.25cm

Q.8) Convert 0 degree Celsius into kelvin:

- a) 212 F
- b) 32 K
- c) -273.16 K
- d) 0.21 R

Q.9) What is the unit of Speed?

- a) Km/Hrs.
- b) m<sup>3</sup>/s
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Q.11) Define Zeroth Law & draw a neat sketch explaining the law?

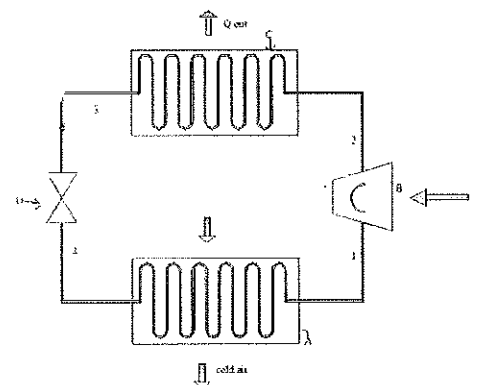
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Q.14) Based on the diagram below Complete the table.

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4	D-	





# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

## Section – C

04X06 = 24 Marks

04 long type questions, each question carries 06 marks.

Q.15) Write about the fundamental units. Mention M.K.S system for

- a) Speed b) Force

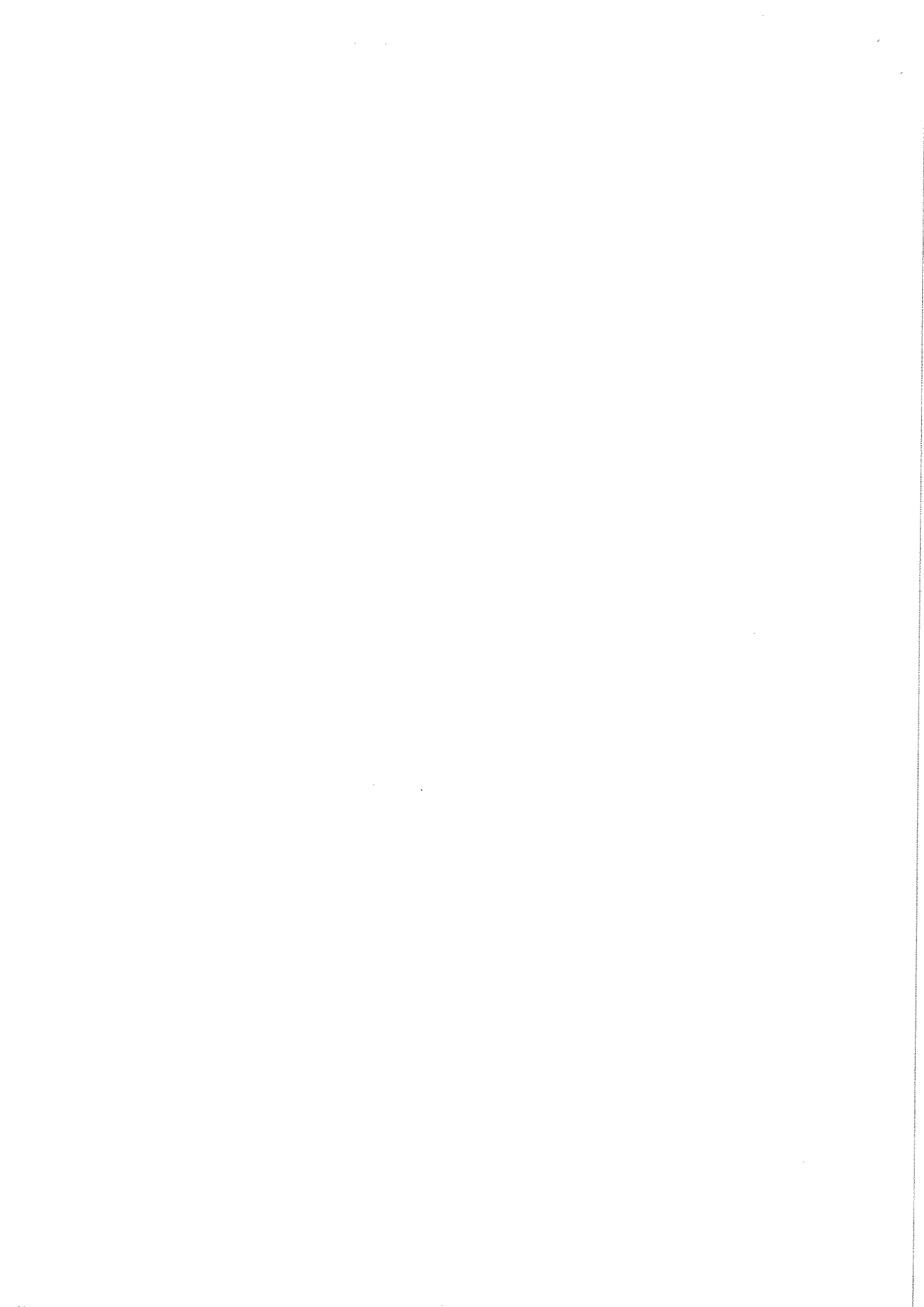
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- a) Displacement    b) Force  
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Q.18) What is fluid? What are its types of flow?

by hardik sharma  
Digi Q





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Registration No.: .....

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Session: 2020-21 (Summer Semester)

B. Voc., I Semester,

End-Sem. Examination

Course Code: RAC 1101

Course Name: Basic of Refrigeration & Air-conditioning

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*Set-B Answer key*  
Time: 2 Hours

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a)  $10^3$

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a) Boundary

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c)-273.16 K

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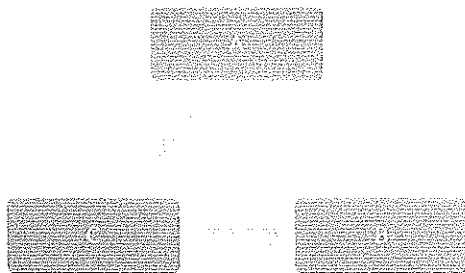


# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Q.11) Define Zeroth Law & draw a neat sketch explaining the law?

A.11 A.11) When a body A is in thermal equilibrium with a body B and separately with a body C, then B and C will be in thermal equilibrium with each other.

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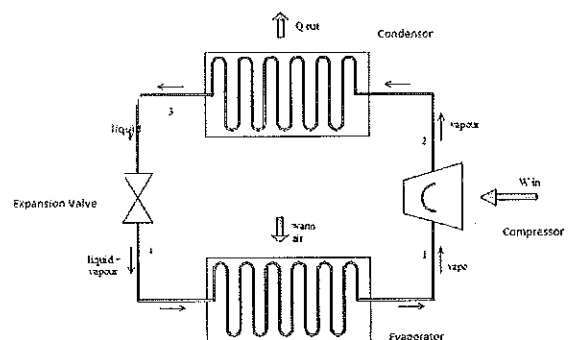
A12)

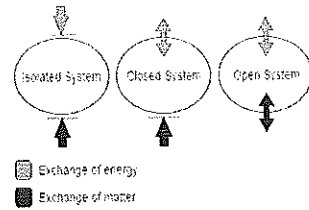
Point	Path
1. They do not depend on the path followed during a process.	1. They depend on the path and not on the initial and final points.
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3. e.g., temperature, volume, pressure, etc.	3. e.g., work, heat etc.

A.13) Convert the following

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- Length 100 ft to 1200 Inches.
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- Time 10 days to 240 Hours.

A.14) Based on the diagram below Complete the table.





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Q.17) Derive the Fundamental unit of the following physical Quantity?

a) Displacement    b) Force

c) Velocity        d) Acceleration

Displacement-Displacement = Length

b) Force= mass \* acceleration

$[M^0L^1T^0]$  =Meter

$[M^1L^2T^{-2}]$ =  $\frac{Kg \cdot m^2}{Sec^2}$  newton

Sec<sup>2</sup>

c) Velocity



LENGTH =  $[M^0L^1T^{-1}]$  METRE/SEC

TIME

d) Acceleration =  $[M^0L^1T^{-2}]$  METRE /SEC<sup>2</sup>

Q.18) What is fluid? What are its types of flow?

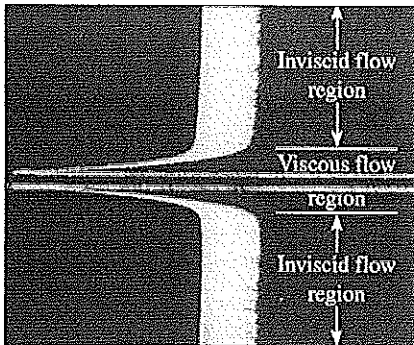
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**Viscous flows:** Flows in which the frictional effects are significant.

**Inviscid flow regions:** In many flows of practical interest, there are *regions* (typically regions not close to solid surfaces) where viscous forces are negligibly small compared to inertial or pressure forces.



*Hydrodynamics*  
*Prigis*  
*A*



**School of Refrigeration & Air Conditioning Skills**

**Session: 2020-21 (Summer Semester)**

**B. Voc. Program, I Semester,**

**End-Sem. Examination**

**Course Code: RAC1102**

**Time: 2 Hours**

**Course Name: Domestic RAC Appliances**

**Max. Marks: 50**

**SET-A**

**Instruction:**

All questions are compulsory.

Section A is objective type.

Section B is short answer type.

Section C is long answer type.

**Section – A**

10X01 = 10 Marks

1. What is the measuring unit Temperature?  
a) Watt                      b) Kelvin                      c) Bar                      d) None
2. What is the name of temperature measuring device?  
a) Thermometer    b) Micrometer                      c) Both                      d) None
3. Which one is more precise, a Vernier caliper with 0.02 mm least count or a micrometer with 0.01 mm least count?  
a) Micrometer    b) Vernier Caliper                      c) Not Comparable    d) None
4. How does the power consumption of AC depend upon its star rating?  
a) Directly Proportional                      b) Inversely Proportional  
c) Equal                      d) None
5. During the AC installation procedure, nitrogen is hold in copper tubes for---.  
a) Leak testing                      b) Pressure testing  
c) Temperature testing                      d) All of the above
6. During the vacuuming of AC, pressure is measured by----.  
a) Compound Gauge                      b) Thermometer  
c) Sling Psychrometer                      d) None
7. Flaring tool is used for-----.  
a) Flare making                      b) Swaging  
c) Both                      d) None
8. Where does the evaporation of refrigerant take place?  
a) Compressor                      b) Condenser  
c) Evaporator                      d) None
9. Where does the condensation of refrigerant take place?  
a) Compressor                      b) Condenser  
c) Evaporator                      d) None



10. The feeler bulb of thermostatic expansion valve is placed---
- a) After evaporator
  - b) Before evaporator
  - c) On evaporator
  - d) None

**Section – B**

04X04 = 16 Marks

1. Write down the state of refrigerant inside all the basic components of a VCRS.
2. Define the term condensation and evaporation.
3. The least count of a Vernier caliper is 0.02 mm and minimum measurable value on its main scale is 1mm. Find the total number of divisions on Vernier scale.
4. the least count of a micrometer is 0.02 mm and total number division is 50. Find out minimum measurable value on main scale.

**Section – C**

04X06 = 24 Marks

1. Explain vapour compression refrigeration system in detail with neat sketch.
2. Write down the pumping down process in detail.
3. Write a note on "Importance of tool box".
4. Give the name of all the parts of a Vernier Caliper with the help of a neat sketch.

*Handwritten signature: R. Singh*



**School of Refrigeration & Air Conditioning Skills**

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**ANSWER KEY-A**

**Course Code: RAC1102**

**Course Name: Domestic RAC Appliances**

**Time: 2 Hours**

**Max. Marks: 50**

**Section – A**

**10X01 = 10 Marks**

1. What is the measuring unit Temperature?  
b) Kelvin
2. What is the name of temperature measuring device?  
a) Thermometer
3. Which one is more precise, a Vernier caliper with 0.02 mm least count or a micrometer with 0.01 mm least count?  
a) Micrometer
4. How does the power consumption of AC depend upon its star rating?  
b) Inversely Proportional
5. During the AC installation procedure, nitrogen is hold in copper tubes for---.  
a) Leak testing
6. During the vacuuming of AC, pressure is measured by----.  
a) Compound Gauge
7. Flaring tool is used for-----.  
a) Flare making
8. Where does the evaporation of refrigerant take place?  
c) Evaporator
9. Where does the condensation of refrigerant take place?  
b) Condenser
10. The feeler bulb of thermostatic expansion valve is placed---.  
a) After evaporator

**Section – B**

**04X04 = 16 Marks**



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Write down the state of refrigerant inside all the basic components of a VCRS.

Ans: Compressor = vapour

Condenser = Vapour to liquid

Expansion device = Liquid (Moderate Temperature) to liquid (Low Temperature)

Evaporator = liquid to Vapour

2. Define the term condensation and evaporation.

Ans: **Condensation** is the change from a vapor to a condensed state.

**Evaporation** is the change of a liquid to a gas.

3. The least count of a Vernier caliper is 0.02 mm and minimum measurable value on its main scale is 1mm. Find the total number of divisions on Vernier scale.

Ans: Least count = Minimum value on main scale/ Total no. of division

Therefore, total no. of division =  $1/0.02$

= 50 ans.

4. the least count of a micrometer is 0.02 mm and total number division is 50. Find out minimum measurable value on main scale.

Ans: Least count = Minimum value on main scale/ Total no. of division

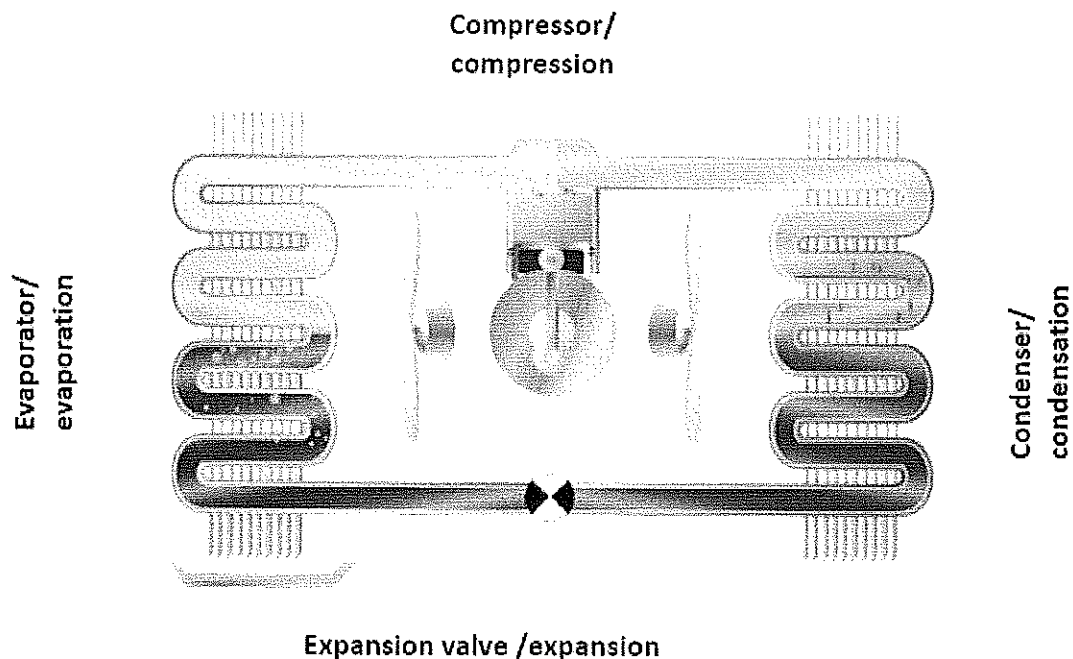
Therefore, Minimum value on main scale =  $50 * 0.02$

= 1 mm ans.

## Section – C

04X06 = 24 Marks

1. Explain vapour compression refrigeration system in detail with neat sketch.



2. Write down the pumping down process in detail.



## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

- a. Switch off the air conditioning unit.
- b. Attach the compound pressure gauge to the vapour line service valve
- c. Turn the knob on the service valve, to position it in between fully opened, and fully closed.
- d. You will notice that the pressure gauge reading will increase
- e. next, operate the air conditioning unit for 3 to 5 minutes,
- f. Isolate the liquid line by closing the liquid line service valve.
- g. You will start to notice the reducing pressure reading on the compound gauge
- h. Isolate the vapour line service valve by closing it, once the pressure reading 0.

3. Write a note on "Importance of tool box".

Sprit level

Bender

Wire cutter

Hammer

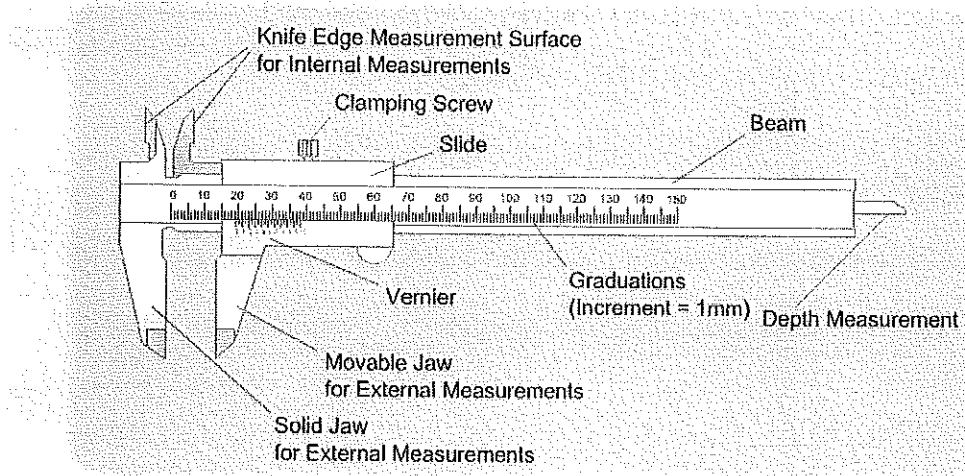
Screw driver

Vacuum pump

Etc.

4. Give the name of all the parts of a Vernier Caliper with the help of a neat sketch.

# Calipers Structure IIIII



~~Hand~~  
Rough



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**SET-B**

**Instruction:**

All questions are compulsory.

Section A is objective type.

Section B is short answer type.

Section C is long answer type.

**Section – A**

10X01 = 10 Marks

1. In which refrigeration system compressor is used?  
a) VCRS                      b) VARS                      c) Both                      d) None
2. What is the measuring unit of electric current is?  
a) Volt                      b) Ampere                      c) Ohm                      d) None
3. The resulting temperature of an AC is ----- than a refrigerator.  
a) More                      b) Less                      c) Equal                      d) None
4. What is the measuring unit power?  
a) Watt                      b) Kelvin                      c) Bar                      d) None
5. For measuring the outer dimension of an object, which jaws of Vernier caliper are used?  
a) Internal Jaws                      b) External Jaws  
c) Both                      d) None
6. The heat exchanger fins are made up of--.  
a) Aluminium                      b) Copper                      c) Steel                      d) None
7. What is the condition of refrigerant at the exit of compressor?  
a) Vapour                      b) Liquid  
c) Mixture                      d) None
8. What is the condition of refrigerant at the exit of condenser?  
a) Vapour                      b) Liquid  
c) Mixture                      d) None
9. What is the condition of refrigerant at the exit of evaporator?  
a) Vapour                      b) Liquid  
c) Mixture                      d) None
10. Star rating of AC is decided by--.  
a) BEE                      b) Manufacturer



c) Both

d) None

**Section – B**

04X04 = 16 Marks

1. What is a compressor and how does it work in a refrigeration system?
2. What is an accumulator
3. What is a heat exchanger and how do you differentiate condenser from evaporator?
4. Convert the following:
  - a) 2 TR = -- HP
  - b) 3 TR = -- KW
  - c) 2 TR = -- BTU
  - d) 2.5 HP = -- BTU
  - e) 24000 BTU = -- KW
  - f) 2.1 Kg = -- gm
  - g) 1.5 mm = ---- Micron
  - h) 70 Micron = --- mm

**Section – C**

04X06 = 24 Marks

1. Explain different type of compressors in detail.
2. Write a note on "Importance of safety".
3. Explain the Micrometer with neat sketch in detail.
4. Write down the vacuuming process in detail.

~~Atul~~  
Singh



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

## School of Refrigeration & Air Conditioning Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, I Semester,

End-Sem. Examination

ANSWER KEY-B

Course Code: RAC1102

Course Name: Domestic RAC Appliances

Time: 2 Hours

Max. Marks: 50

### Section – A

10X01 = 10 Marks

1. In which refrigeration system compressor is used?
  - a) VCRS
2. What is the measuring unit of electric current is?
  - b) Ampere
2. The resulting temperature of an AC is ----- than a refrigerator.
  - a) More
3. What is the measuring unit power?
  - a) Watt
4. For measuring the outer dimension of an object, which jaws of Vernier caliper are used?
  - b) External Jaws
6. The heat exchanger fins are made up of--.
  - a) Aluminium
7. What is the condition of refrigerant at the exit of compressor?
  - a) Vapour
8. What is the condition of refrigerant at the exit of condenser?
  - b) Liquid
9. What is the condition of refrigerant at the exit of evaporator?
  - c) Mixture
10. Star rating of AC is decided by--.
  - a) BEE

### Section – B

04X04 = 16 Marks

1. What is a compressor and how does it work in a refrigeration system?



Ans:

A compressor is the most important and often the costliest component (typically 30 to 40 percent of total cost) of any vapour compression refrigeration system (VCRS). The function of a compressor in a VCRS is to continuously draw the refrigerant vapour from the evaporator and then to raise the pressure of the refrigerant. An air conditioner compressor is the component in the system that raises the temperature and pressure of the vapor refrigerant that leaves the evaporator coil. Its important that the compressor raises the pressure of the vapor refrigerant so that it creates a pressure difference, the pressure difference is needed in order for the refrigerant to flow. High pressure fluids flow towards lower pressure fluid. Basically what happening is the compressor is raising the pressure of the refrigerant so that the refrigerant will flow to the lower pressure refrigerant in the evaporator coil.

2. What is an accumulator?

An AC accumulator is used to collect and store any liquid refrigerant that may flow out of the evaporator coil. Since liquids cannot be compressed, it's critical that only refrigerant gas enters the AC compressor. The accumulator allows only a regulated amount of refrigerant oil and refrigerant gas to enter the AC compressor. As liquid refrigerant and oil enter the accumulator inlet, they hit a baffle near the top that distributes the oil and liquid to the sides of the accumulator, where it falls to the bottom. A U-shaped tube is attached to the outlet of the accumulator. The inlet to the U-shaped tube is located near the top of the accumulator so it can't suck any liquid refrigerant into the compressor. The tube contains an oil suction hole at the base.

3. What is a heat exchanger and how do you differentiate condenser from evaporator?

Ans:

A heat exchanger is a system used to transfer heat between two or more fluids. Heat exchangers are used in both cooling and heating processes. The fluids may be separated by a solid wall to prevent mixing or they may be in direct contact. They are widely used in space heating, refrigeration, air conditioning, power stations, chemical plants, petrochemical plants, petroleum refineries, natural-gas processing, and sewage treatment. The classic example of a heat exchanger is found in an internal combustion engine in which a circulating fluid known as engine coolant flows through radiator coils and air flows past the coils, which cools the coolant and heats the incoming air. Another example is the heat sink, which is a



passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant

4. Convert the following:

- a) 2 TR = 2.5 HP      b) 3 TR = 10.5 KW      c) 2 TR = 24000 BTU      d) 2.5 HP = 24000 BTU  
e) 24000 BTU = 7 KW      f) 2.1 Kg = 2100 gm      g) 1.5 mm = 1500 Micron  
h) 70 Micron = 0.07 mm

## Section – C

04X06 = 24 Marks

1. Explain different type of compressors in detail.

### Reciprocating Compressor

The reciprocating compressor is the most popular type of AC compressor. A piston compresses the air by moving up and down inside of a cylinder. As the piston moves down, it creates a vacuum effect that sucks in the refrigerant. As it moves up, the gas compresses and moves into the condenser. A reciprocating air conditioning compressor is very efficient, as AC units can have up to eight cylinders within the compressor.

### Scroll AC Compressor

Scroll air conditioning compressors. They contain one fixed coil—called the scroll—in the centre of the unit, and then there is another coil that rotates around it. During this process, the second scroll pushes the refrigerant towards the centre and compresses it. Scroll compressors are quickly becoming as popular as reciprocating compressors because they do not have as many moving parts and are therefore more reliable.

### Rotary Air Conditioning Compressor

Rotary compressors are small and quiet, so they are popular in locations where noise is a concern. The inside of this type of AC compressor contains a shaft with several blades attached to it. The bladed shaft rotates inside the graduated cylinder, consequently pushing the refrigerant through the cylinder and compressing it simultaneously.

### Centrifugal Air Conditioning Compressor

The final type of AC compressor is the centrifugal compressor. As the name implies, it uses centrifugal force to pull in the refrigerant gas and then spins it rapidly with an impeller to compress it. Centrifugal air conditioning compressors are usually reserved for extra large HVAC systems.

### Screw AC Compressor



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The screw compressor is extremely reliable and efficient, but it is mainly used in large buildings where there is a vast amount of air that requires continuous cooling. A screw air conditioning compressor contains two large helical rotors that move the air from one end to the other. As the refrigerant moves through the compressor, the space gets smaller, and it gets compressed.

2. Write a note on "Importance of safety".

**Ans:**

Working as an HVAC technician in the field of heating, cooling, and air can be a rewarding career choice. The opportunity to actively problem solve while enjoying a stable salary, the field of HVAC certainly has its advantages. However, while working in heating, cooling and air offers numerous benefits, that doesn't mean there are not precautions as well and whether you've been working in this field for a few months or a few years, you will want to know these 5 important safety tips.

## 1.) Make Protection a Priority

The most effective way to stay safe while on the job? Make protection a priority. Anytime you are being exposed to contaminants such as dust or other debris, you will need protective equipment like a respirator to avoid inhaling these harmful substances. In addition, you'll also want to make sure to wear goggles or some type of face shield to keep your eyes safe from harmful exposure. Gloves should also be worn when handling particles and anything that has the potential to cut you. Remember, safety starts with protection first

## 2.) Assess the Situation at Hand

In addition to using protective equipment to ensure your safety, you will also want to assess the situation at hand. Before jumping into a task, take the time to identify any potential hazards that may be present on the job site. Each job is a unique situation and location, so it's wise to take the necessary safety precautions beforehand. While it can be tempting to immediately start on a job, it's better to take the time to get the job done and do it right than to just rush through everything.

## 3.) Double-Check Your Equipment

Moving from one job site to the next is a common scenario for many HVAC technicians. So having the right tools for the job is crucial when it comes to heating and air. Before starting a job, assess the required tools you will need in order to complete the job. Whether a wrench, wire strippers, or even a vacuum gauge it's important to always double-check your equipment. Keeping everything in order is important for completing the task at hand while also keeping you safe in the process. Using faulty equipment is more likely to lead to injury so performing routine maintenance is key.

## 4.) Don't Take Shortcuts

In addition to double-checking your equipment, you will also want to make sure you're not taking any shortcuts. As an HVAC technician, you're working with chemicals, electricity and in some cases extreme temperatures on a regular basis. And while taking a shortcut might save you a few seconds, exercising caution should be your number one priority. In order to truly be safe on the job, technicians must follow procedure.

## 5.) Exercise Caution Around Chemicals

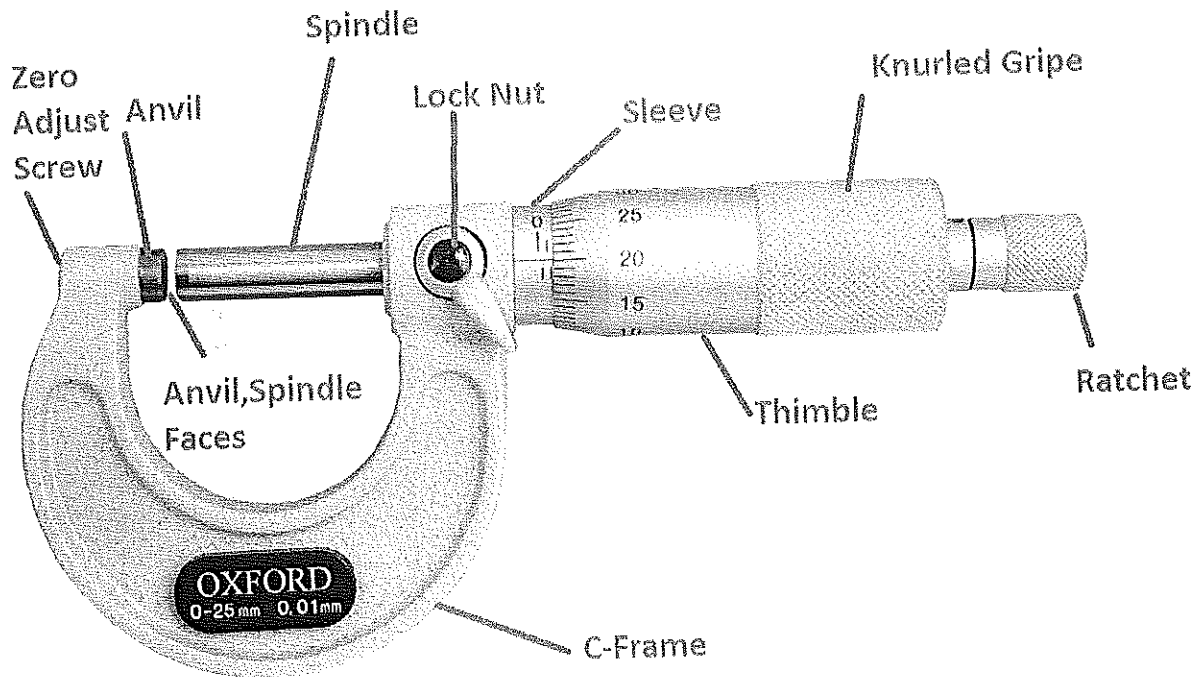
While HVAC technicians face a number of potential hazards while on the job, caution must especially be adhered to when it comes to chemicals.



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With the potential to cause bodily harm, chemicals need to be stored and handled properly in order to prevent serious damage.

3. Explain the Micrometer with neat sketch in detail.



Micrometer Parts

4. Write down the vacuuming process in detail.

## STEP 1: LOCATING HIGH AND LOW SIDE SERVICE PORTS

Park the vehicle on a level surface with the engine off. Apply the emergency brake with the transmission in park and wear protective eye wear and gloves. After replacing a failed component the system is "flat" you are now ready to vacuum the system down and recharge it. The high side port should be on the line between the condenser and the expansion valve or orifice tube while the low side port will be on the return line between the evaporator (firewall) and compressor.

The high side port is larger in size than the low side. If you are servicing the system or doing repairs that require the removal for the refrigerant continue down to the guide to the refrigerant removal section.

## STEP 2: PREPARE THE GAUGE SET

A gauge set is needed to connect to the system on both high and low side pressure ports and it will also be used to vacuum down and recharge the system. Inspect the connections to make sure they are tight to avoid leakage. These units must be "air tight" and not have any leaks at hose fittings or valves. The red colored gauge and connector valve represents the high pressure side of the system while the blue color represents the low pressure side. The center hose (yellow) is connected to the



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vacuum pump and then the new refrigerant supply bottle or can. Both gauge valves should be closed before attaching them to the system.

### STEP 3: CONNECT THE GAUGES TO THE SYSTEM

After repairs have been made locate the low side service port on the return hose to the compressor and then connect your gauges to the port by lifting up the connector ring and pushing downward. Then turn the valve screw (blue part) inward (clockwise) this will open the service valve below. Repeat this process for both high and low side ports. The high and low side fittings will only work on their respective ports due to size constraints to avoid confusion. Once secured tighten the valve which activates the internal plunger that opens the service port valve to the refrigerant lines.

### STEP 4: GAUGE READINGS

Now observe both high and low side gauges with the valves closed there should be little to no pressure in the system.

### STEP 5: CONNECT THE VACUUM PUMP

Connect the centre hose from the gauge set (yellow) to the vacuum pump and turn the unit on. This step is used to remove any moisture and static air from inside the system. These systems have a mixture of refrigerant and oil to keep the air conditioning compressor lubricated during operation. Measuring the amount of (peg) oil in the system is difficult because it's spread throughout the system, in other words if there is a major leak and oil is dripping out the system will need a small amount of oil. Unlike a very small leak which releases little to no oil you must be the judge of this and add appropriately.

### STEP 6: VACUUM THE SYSTEM

Slowly open the low side gauge valve the pump will now start pulling vacuum throughout the system as the gauge needle slowly moves into vacuum. The pump will change in tone once the valve has been opened and it starts to pull air out of the system. Once the vacuum pump has been on for 30 minutes close the low side valve and turn the pump off. The system should hold at 28-29 inches. If the system never reaches 28-29 inches there is a large leak. If the system loses vacuum after the valve is closed there is a small leak and the system must be rechecked. System leaks can include a faulty O ring seal or a loose hose on the valve set. If the system holds vacuum for 15 minutes proceed to the next step.

*Handwritten signature:*  
Rough



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

## School of Refrigeration & Air Conditioning Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, I Semester,

End-Sem. Examination

Course Code: RAC1103

Time: 2 Hours

Course Name: RAC Electricals, Electronics & Instrumentation-I

Max. Marks: 50

Instruction:

Set - A  
Section - A

10X01 = 10 Marks

1. What happens when magnet is at rest :  
a) No deflection                      b) Slight deflection                      c) Right deflection  
d) None
2. What is the measuring unit of electric current?  
a) Volt                      b) Ampere                      c) Ohm                      d) None
3. Fuse is used to protect  
a) resistance                      b) voltage                      c) power                      d) None
4. What is the measuring unit of power?  
a) Watt                      b) Kelvin                      c) Bar                      d) None
5. Kirchoffs first law is  
a) Current law                      b) Voltage law  
c) Both                      d) None
6. In ohms law Voltage is  
a)  $I \times R$                       b)  $W/J$                       c)  $I \times V$                       d) None
7. Capacitor is also known as  
a) Resistor                      b) Inductor  
c) Condenser                      d) None
8. Live wire is represented by which colour  
a) Blue                      b) Black  
c) Red                      d) None
9. Distribution box is mainly consists of  
a) Circuit Breakers                      b) Trip switch  
c) Main switch                      d) All of the above
10. The direction of induced current can be determined by flemings  
a) Left hand rule                      b) Right hand rule  
c) Both                      d) None



**Section – B**

04X04 = 16 Marks

1. Explain semiconductors?
2. What is resistor and how we find the value of a resistor.
3. Explain difference between AC and DC.
4. Explain V-I characteristics with a neat sketch.

**Section – C**

04X06 = 24 Marks

1. Explain different components used in house wiring
2. Write a note on wires and cables.
3. Explain the mutually induced emf with a neat sketch.
4. Write a note on ohm law.

*R Singh*  
*[Signature]*



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Refrigeration & Air Conditioning Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, I Semester,

End-Sem. Examination

ANSWER KEY

Course Code: RAC1103

Course Name: RAC Electricals, Electronics & Instrumentation-I

Time: 2 Hours

Max. Marks: 50

Set - A

Section - A

10X01 = 10 Marks

1. What happens when magnet is at rest :
  - a) No Deflection
2. What is the measuring unit of electric current?
  - b) Ampere
3. Fuse is used to protect
  - d) None
4. What is the measuring unit of power?
  - a) Watt
5. Kirchoffs first law is
  - a) Current Law
6. In ohms law Voltage is
  - a)  $I \times R$
7. Capacitor is also known as
  - c) Condenser
8. Live wire is represented by which colour
  - c) Red
9. Distribution box is mainly consists of
  - d) All of the above
10. The direction of induced current can be determined by flemings
  - a) Left hand rule

Section - B

04X04 = 16 Marks

1. Explain semiconductors?

Ans: Semiconductors are materials which have a conductivity between conductors (generally metals) and nonconductors or insulators (such as most ceramics).

Semiconductors can be pure elements, such as silicon or germanium, or compounds such as gallium arsenide or cadmium selenide.



2. What is resistor and how we find the value of a resistor.

**Ans:** A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

3. Explain difference between AC and DC.

**Ans:** Basis

Alternating current. Direct current

Definition

The direction of the current reverse periodically.

The direction of the current remains the same.

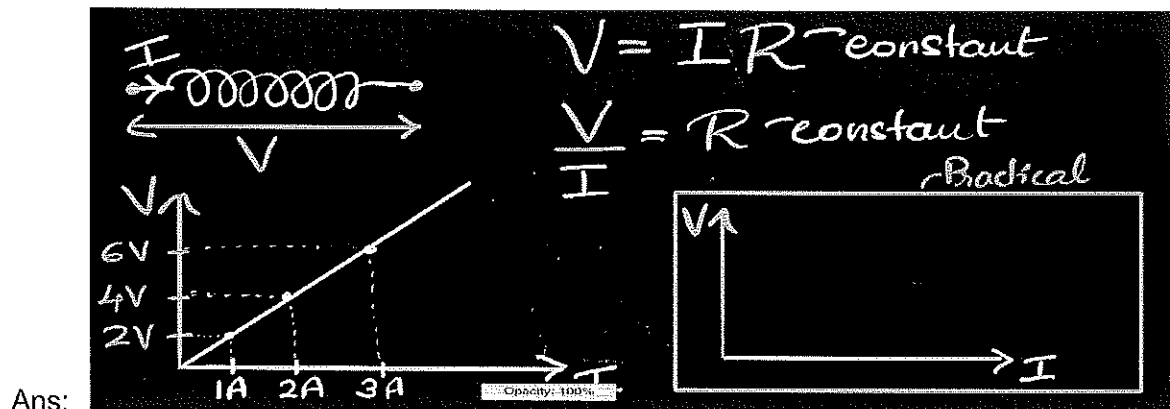
Causes of flow of electrons

Rotating a coil in a uniform magnetic field or rotating a uniform magnetic field within a stationary coil. Constant magnetic field across the wire

Frequency

50 or 60 Hertz, Zero

4. Explain V-I characteristics with a neat sketch.



## Section – C

04X06 = 24 Marks

1. Explain different components used in house wiring

Components used in house wiring are :

1. Energy Meter.
2. Fuse
3. Distribution box which includes main switch, Trip Switch, Circuit breakers
4. Wall switch
5. Plug sockets
6. Wires and Cables



2. Write a note on wires and cables.

Ans: Wires: In house wiring, generally we use poly vinyl chloride wire. PVC coating on copper conductor wires. so it has many advantages as follows.

- (a) High dielectric strength
- (b) High tensile strength
- (c) More defence against moisture
- (d) High life

Widely used Long life Durable against water, heat, oil, UV light

Cables: A power cable is an assembly of two or more electrical conductors, usually held together with an overall sheath. The assembly is used for transmission of electrical power. Power cables may be installed as permanent wiring within buildings, buried in the ground. Flexible power cables are used for portable devices, mobile tools and machinery. It is available in different sizes according to its no. of core wires in it.

PVC cable 2C, 1.5 Sq. mm.

PVC cable 3C, 1.5 Sq. mm.

PVC cable 3C, 2.5 Sq. mm.

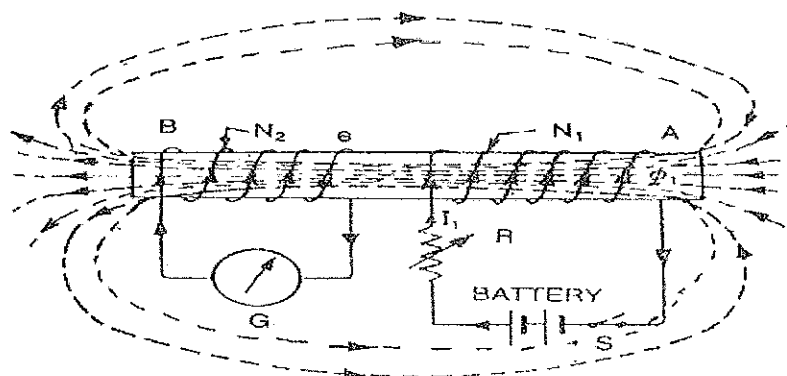
PVC cable 5C, 2.5 Sq. mm.

3. Explain the mutually induced emf with a neat sketch.

### Mutually Induced EMF

Definition: The emf induced in a coil due to the change of flux produced by another neighbouring coil linking to it, is called Mutually Induced emf. Let us take an example to understand the phenomenon of mutually induced emf.

Consider a coil AB. Coil B is having  $N_2$  number of turns and is placed near another coil A having  $N_1$  number of turns, as shown in the figure below:



4. Write a note on ohm law.

Ans: Ohm's Law

Ohm's Law is the fundamental equation for electricity and governs the vast majority of electrical work that we do. It was named after George Ohm, a German physicist who published a treatise in 1827. In it, he explained measurements of applied voltage and current by using a simple electrical circuit made with varying lengths of wire.



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It is also called the formula used to calculate the relationship between the voltage, current and resistance in an electrical circuit.

The law states that electrical current in a circuit or conductor will always be proportionate to the voltage across the conductor or circuit, and inversely proportional to the total resistance.

$$V \text{ (voltage)} = I \text{ (current)} \times R \text{ (resistance)}$$

where V is the voltage across the circuit.

I is the current flowing in a circuit and R is the resistance offered.

*Singh*



## School of Refrigeration & Air Conditioning Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, I Semester,

End-Sem. Examination

Course Code: RAC1103

Time: 2 Hours

Course Name: RAC Electrical, Electronics & Instrumentation-I

Max. Marks: 50

Instruction:

Set - B

### Section – A

10X01 = 10 Marks

- DC generators works on the principle of :  
a) Dynamically induced EMF      b) Self induced EMF      c) Statically induced EMF      d) None
- 1 DC volt is equal to how many AC volts?  
a) 1.569      b) 1.414      c) 1.709      d) None
- Circuit breaker is used to protect  
a) Appliances      b) voltage      c) power      d) None
- What is the measuring unit of resistance?  
a) Watt      b) Kelvin      c) Ohm      d) None
- Kirchoff's second law is  
a) Current law      b) Voltage law  
c) Both      d) None
- In series connection Total Resistance is equal to is  
a)  $R_1+R_2+R_3+R_4$       b)  $R_1+R_2=R_3+R_4$       c)  $1/R_1+1/R_2+1/R_3+1/R_4$   
d) None
- PVC coating on copper conductor wires has advantages like  
a) High Dielectric strength      b) High life  
c) High tensile strength      d) All of the above
- Earthing wire is represented by which colour  
a) Blue      b) Black  
c) Red      d) Green
- Three phase wiring is used to accommodate  
a) Current      b) High loads and currents  
c) Low loads and currents      d) All of the above
- Type of semiconductor is  
a) Intrinsic      b) Extrinsic  
c) Both      d) None



**Section – B**

04X04 = 16 Marks

1. Explain diodeWrite a note on transistors?
2. Explain three phase wiring.
3. Explain different types of cables.
4. Explain the working of RCCB.

**Section – C**

04X06 = 24 Marks

1. Explain faraday's first and second law
2. Write a note on transistors
3. Explain the statically induced emf with a neat sketch.
4. Write a note on kirchhoff first and second law with a neat sketch.

*R Singh*  
*Q*



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

## School of Refrigeration & Air Conditioning Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, I Semester,

End-Sem. Examination

### ANSWER KEY

Course Code: RAC1103

Course Name: RAC Electricals, Electronics & Instrumentation-I

Time: 2 Hours

Max. Marks: 50

Set - B

#### Section – A

10X01 = 10 Marks

1. DC generators works on the principle of :
  - a) Dynamically induced EMF
- 2.1 DC volt is equal to how many AC volts?
  - b) 1.414
3. Fuse is used to protect
  - d) None
4. Circuit breaker is used to protect
  - a) Appliances
5. What is the measuring unit of resistance?
  - c) Ohm
6. Kirchoff's second law is
  - b) Voltage law
7. In series connection Total Resistance is equal to is
  - a)  $R_1+R_2+R_3+R_4$
8. Earthing wire is represented by which colour
  - d) Green
9. Three phase wiring is used to accommodate
  - b) High loads and currents
10. Type of semiconductor is
  - c) Both

#### Section – B

04X04 = 16 Marks

1. Explain diode?

Ans: A diode is defined as a two-terminal electronic component that only conducts current in one direction (so long as it is operated within a specified voltage level). An ideal diode will have zero resistance in one direction, and infinite resistance in the reverse direction

2. Explain three phase wiring.

**Ans:** Three-phase power is a three-wire ac power circuit with each phase ac signal 120 electrical degrees apart. Residential homes are usually served by a single-phase power supply, while commercial and industrial facilities usually use a three-phase supply. One key difference between single-phase

3. Explain different types of cables.

**Ans:** The function of a cable depends upon the type of cable. The electrical cables are made of aluminium or copper wires protected by an insulating coating which can be made of synthetic polymers.

Cables are classified into 5 types depending upon their purpose as follows:

**Ribbon Electric Cables**

It consists of multiple insulated wires running parallel with one another and is used for transmission of multiple data simultaneously.

**Shielded Cables**

It consists of 1 or 2 insulated wires which are covered by a woven braided shield or aluminium Mylar foil for better signal transmission and removing irregularities in the frequency of power and external interference in radio.

**Twisted Pair Cables**

It has two or more insulated copper wires which are twisted with each other and are colour-coded.

**Coaxial Cables**

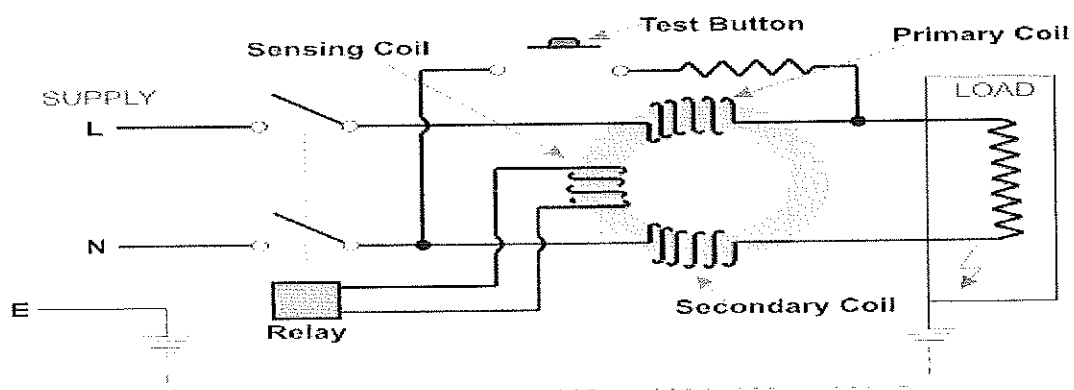
This consists of a solid copper or steel conductor plated with copper which is enclosed in the metallic braid and metallic tape.

**Fibre Optics Cable**

There are these types of cables which transport optical data signals from an attached light source to the receiving device.

4. Explain the working of RCCB.

**Ans:**

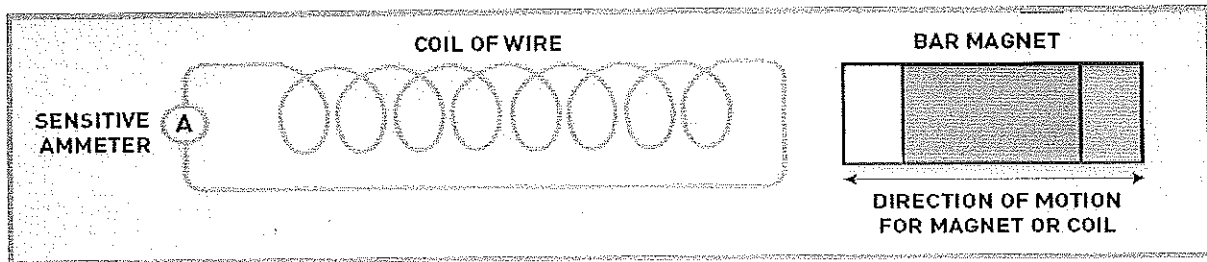


**Working Principle of Residual Current Circuit Breaker**

## Section – C

04X06 = 24 Marks

1. Explain faraday's first and second law



Whenever a conductor is placed in a varying magnetic field, an electromotive force is induced. If the conductor circuit is closed, a current is induced which is called induced current.

The induced emf in a coil is equal to the rate of change of flux linkage.

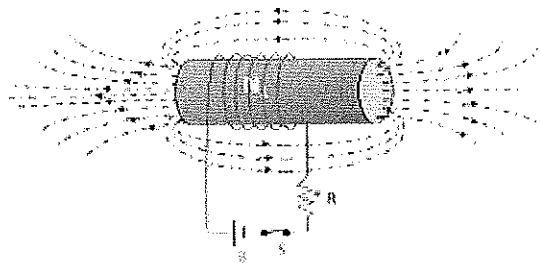
2. Write a note on transistors

Ans: A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. Transistors are one of the basic building blocks of modern electronics. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit.

Transistor, semiconductor device for amplifying, controlling, and generating electrical signals. Transistors are the active components of integrated circuits, or "microchips," which often contain billions of these minuscule devices etched into their shiny surfaces.

3. Explain the statically induced emf with a neat sketch.

The emf induced in a coil due to change of flux linked with it (change of flux is by the increase or decrease in current) is called statically induced emf. Transformer is an example of statically induced emf. Here the windings are stationary, magnetic field is moving around the conductor and produces the emf.



4. Write a note on kirchhoff first and second law with a neat sketch.

Ans: Kirchhoff's First Law

This is the first:



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At any junction in a circuit, the sum of the currents arriving at the junction = the sum of the currents leaving the junction.

### Kirchhoff's Second Law

Here is the second principle:

In any loop (path) around a circuit, the sum of the emfs = the sum of the pds.

In other words - energy is conserved. The total amount of energy put in (sum of the emfs) is the same as the total amount of energy taken out (sum of the pds).

*Singh*



**School of Refrigeration & Air Conditioning**

**Session: 2020-21 (Summer Semester)**

**B. Voc., I Semester,**

**End-Sem. Examination**

*Set A*

**Course Code: RAC 1104**

**Time: 2 Hours**

**Course Name: RAC Materials and joining processes**

**Max. Marks: 50**

**Instruction: Read the questions Carefully**

Do, mention the Units Also, where Required.

**Section – A**

10X01 = 10 Marks

Q1. Which among is used for Permanent joining process?

- a) Cotter pin knuckle joint.
- b) Brazing and welding
- c) Bolts and nuts
- d) Option A, C both

Q2. Area is \_\_\_\_\_

- a) 2-Dimensional
- b) 3-Dimensional
- c) Space
- d) None of the above option

Q3. Acetylene Cylinder Line pressure & cylinder pressure are \_\_\_\_\_

- a) 0.25 bar & 200 bar
- b) 0.5psi & 200 psi
- c) 0.5bar & 200 psi
- d) 0.25bar & 19bar

Q4. Why are flux used?

- a) To prevent the work piece to form oxide (Oxidation)
- b) To Provide filler with clear surface
- c) To prevent the work piece to have Carbon deposition.
- d) All the above option

Q5. Hand shut valve is a NRV to control \_\_\_\_\_

- a) Control flow of gas outside the nozzle
- b) Oxygen in Cutting torch
- c) Reduce the outlet of cylinder.
- d) To ensure proper flow of oxygen

6). Primary Classification Types of Joining Process are?

- a) Welding and brazing
- b) Nut & bold
- c) Temporary & Permanent
- d) Adhesive

7. In OXY-FUEL Process which has high pressure?

- a) Butane



- b) Acetylene
- c) Oxygen
- d) Argon

8. Oxygen cylinder Line pressure & cylinder pressure are

- a) 0.25 bar & 200 bar
- b) 0.5psi & 200 psi
- c) 0.5bar & 200 psi
- d) 0.25Psi & 19bar

9. Colour coding for Oxygen & Acetylene

- a) Red & Blue
- b) Black & white
- c) Blue & Red
- d) maroon & Ruby Red

10. Welding Electrode 6013?

- a) Cellulose Electrode
- b) Rutile Electrode
- c) Basic Electrode
- d) Special Purpose Electrode

**Section – B**

04X04 = 16 Marks

Q11. What are the safety precautions to be taken in consideration during brazing?

Q12. Difference between Temporary and permanent joints?

Q13. Define Brazing & Temperature Range for Brazing?

Q14. Name the tools Used for sheet Metal working Process?

**Section – C**

06X04 = 24 Marks

Q15. Draw the neat sketch of brazing setup and label each of the component.?

Q16. Calculate the following Area, Perimeter?

Triangle with equal sides of 2cm each

square with side 10 cm

Circle with radius 8 cm

Q17. Name and Define the Types of refrigerants?

Q18. Write in brief about Safety used during Welding?

*By Anand Chandra*  
*Raj*  
*A.*



School of Refrigeration & Air Conditioning

Session: 2020-21 (Summer Semester)

B. Voc., I Semester,

End-Sem. Examination

*Answer Key*

Course Code: RAC 1104

Time: 2 Hours

Course Name: RAC Materials & Joining processes

Max. Marks: 50

Instruction: Read the questions Carefully

Do, mention the Units Also, where Required.

Section – A

10X01 = 10 Marks

Q1. Which among is used for Permanent joining process?

B) Brazing and welding

Q2. Area is \_\_\_\_\_

a) 2-Dimensional

Q3. Acetylene Cylinder Line pressure & cylinder pressure are \_\_\_\_\_

d) 0.25bar & 19bar

Q4. Why are flux used?

d)All the above option

Q5. Hand shut valve is a NRV to control \_\_\_\_\_

B) Oxygen in Cutting torch

6). Primary Classification Types of Joining Process are?

c)Temporary & Permanent

7.In OXY-FUEL Process which has high pressure?

c)Oxygen

8.Oxygen cylinder Line pressure & cylinder pressure are

d)0.5bar & 200 psi

9. Colour coding for Oxygen & Acetylene

c)Blue & Red

10.Welding Electrode 6013?

b) Rutile Electrode

Section – B

04X04 = 16 Marks

Q11. What are the safety precautions to be taken in consideration during brazing?



A11.

Q1 ➤ Use the tools and equipment with care;

A1 ➤ If needed to apply flux, do not use with fingers;

Te ➤ Nitrogen introduction as protective gas low flow rate  
inside the pipe assembly during brazing process is good  
method to avoid oxidation;

Te ➤ Protect the service valves with wet rags or heat sink  
as material;

th ➤ Use only recommended fillers for various joints;

Te ➤ Never reach temp beyond limits, Keep heating both the  
pr tubes, evenly.

Strength of temporary joint is comparatively less.	Strength of permanent joint is high. Usually joint strength is same with that of the components.
Repair and replacement are also easy.	Repair and replacement are difficult and costly.

Q13. Define Brazing & Temperature Range for Brazing?

A13. Brazing is non detachable joining process most common in AIR-CONDITIONING or pipelines for producing tough, strong and leak proof joint.

Temperature range for brazing is Above 450 Degree and below 1000 Degree

In brazing the base metal is heated and the filler rod is used to deposit the molten metal pool for solidification

Q14. Name the tools Used for sheet Metal working Process?

A.14

Sr No.	Measuring	Marking	Cutting
1	Steel ruler- for measuring linear	Scribe- deepen marks	Shear Table-



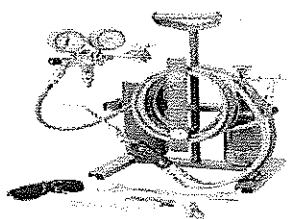
# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

2	Measuring tape	centre punch	notch
3	Feller gauge	prick punch	Pad brake
4	Steel wire and Sheet metal gauge	Grooving stake	Combination snip
5	Angle plate	scriber	Tinner snips Left & Right
6	Combination square	Divider	Circle cutter
7	Try square	Marker	Drill MACHINE
8	Vernier calliper		Drill bit

## Section – C

06X04 = 24 Marks

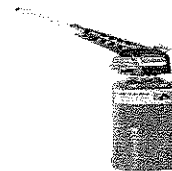
Q15. Draw the neat sketch of brazing setup and label each of the component?



Brazing tool kit



Brazing Nozzle



Brazing tool kit



Filler Material



Heat Deflector

A.15

Usage of flux powder , liquid and Injectables

Q16. Calculate the following Area, Perimeter?

Triangle with equal sides of 2cm each

square with side 10 cm

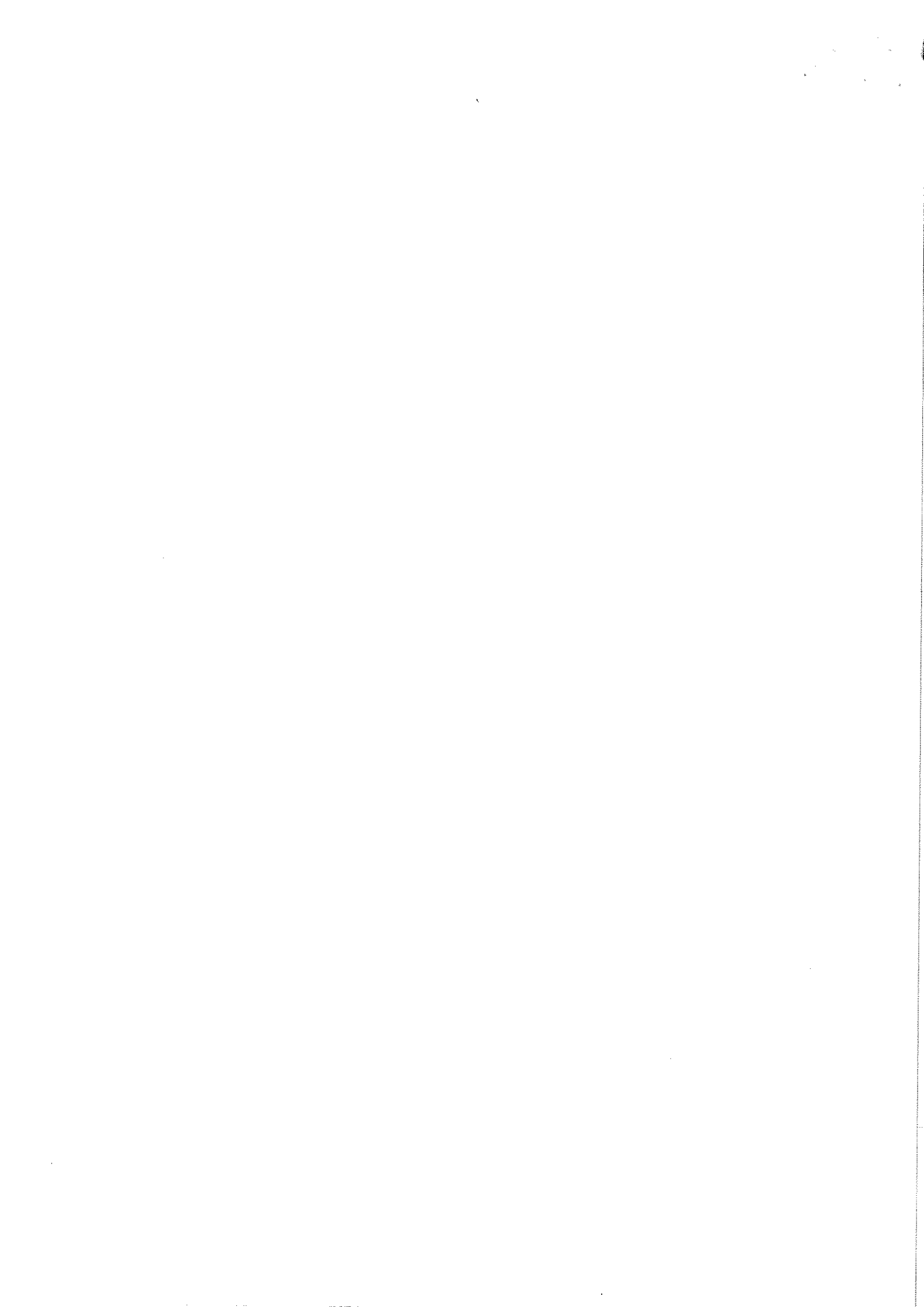
Circle with radius 8 cm

a) A.16 Triangle with equal sides of 2cm each

$$= \text{Area for equilateral triangle equal to } = \frac{\sqrt{3} \times (2\text{cm})^2}{4} = 1.73\text{cm square}$$

$$\text{Perimeter} = 3a = 6 \text{ cm}$$

*Harshat Sharma*  
*Rushik*





School of Refrigeration & Air Conditioning

Session: 2020-21 (Summer Semester)

B. Voc., I Semester,

End-Sem. Examination

Set-B

Course Code: RAC 1104

Time: 2 Hours

Course Name: RAC Material & Joining Processes

Max. Marks: 50

Instruction: Read the questions Carefully

Draw a neat sketch where needed.

Section – A

10X01 = 10 Marks

Q1. Among the following which properties are physical properties of metals?

- a) Chemical stability
- b) Ductility
- c) Malleability
- d) Both b & c

Q2. Area is \_\_\_\_\_

- a) 2-Dimensional
- b) 3-dimensional
- c) Space
- d) Point

Q3. Oxygen is used in brazing for \_\_\_\_\_

- a) Combustion
- b) Fuel gas
- c) Clear space
- d) Heat transfer

Q4. Flux is used for \_\_\_\_\_ during brazing.

- a) To prevent the work piece to form oxide (Oxidation)
- b) To Provide filler with clear surface
- c) To prevent the work piece to have Carbon deposition.
- d) All the above option

Q5. Nozzles in torch are used for \_\_\_\_\_?

- a) Penetration of heat
- b) Heat flux to increase.
- c) Provide ease of filler to deposit.
- d) All the above

6. Primary Classification Types of Joining Process are?

- a) Nut bolts
- b) Washers



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- c) Temporary & Permanent
- d) Brazing

7. Acetylene gas is a \_\_\_\_\_ gas.

- a) Fuel gas
- b) Support gas
- c) Combustion gas
- d) None of the above

8. Safety During flame ignition is \_\_\_\_\_

- a) Use spark Igniter
- b) Usage of lighter
- c) High pressure of gases
- d) Torch angle

9. Colour coding for Oxygen & Acetylene

- a) Blue & black
- b) Red & pink
- c) Blue & red
- d) White & black

10. Welding Electrode 6013?

- a) Basic
- b) Rutile Electrode
- c) Cellulose
- d) Sparklers

## Section – B

04X04 = 16 Marks

Q11. What are the safety precautions to be taken in consideration during brazing?

Q12. Difference between Temporary and permanent joints?

Q13. Draw and Define the Vernier caliper used for measuring?

Q14. Name the tools Used for sheet Metal working Process?

## Section – C

06X04 = 24 Marks

Q15. Draw the neat sketch of brazing setup and label each of the component?

Q16. Calculate the following Area, Perimeter?

Q17. Name and Define the Types of refrigerants?

Q18. Write in brief about Safety used during welding?

*Atul Kishore Singh*  
*Singh*



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Registration No.: .....

School of Refrigeration & Air Conditioning

Session: 2020-21 (Summer Semester)

B. Voc., I Semester,

End-Sem. Examination

*Answer key*

Course Code: RAC1104

Time: 2 Hours

Course Name: RAC Material & Joining Processes

Max. Marks: 50

Instruction: Read the questions Carefully

Draw a neat sketch where needed.

## Section – A

10X01 = 10 Marks

Q1. Among the following which properties are physical properties of metals?

d) Both b & c

Q2. Area is \_\_\_\_\_

a) 2-Dimensional

Q3. Oxygen is used in brazing for \_\_\_\_\_

a) Combustion

Q4. Flux is used for \_\_\_\_\_ during brazing.

d) All the above option

Q5. Nozzles in torch are used for \_\_\_\_\_?

d) All the above

6. Primary Classification Types of Joining Process are?

c) Temporary & Permanent

7. Acetylene gas is a \_\_\_\_\_ gas.

a) Fuel gas

8. Safety During flame ignition is \_\_\_\_\_

a) Use spark Igniter

9. Colour coding for Oxygen & Acetylene

c) Blue & red

10. Welding Electrode 6013?

b) Rutile Electrode

Q11. What are the safety precautions to be taken in consideration during brazing?

A.11

- Use the tools and equipment with care;
- If needed to apply flux, do not use with fingers;
- Nitrogen introduction as protective gas low flow rate inside the pipe assembly during brazing process is good method to avoid oxidation;
- Protect the service valves with wet rags or heat sink material;
- Use only recommended fillers for various joints;
- Never reach temp beyond limits, Keep heating both the tubes, evenly.

g of  
1g

Strength of temporary joint is comparatively less.

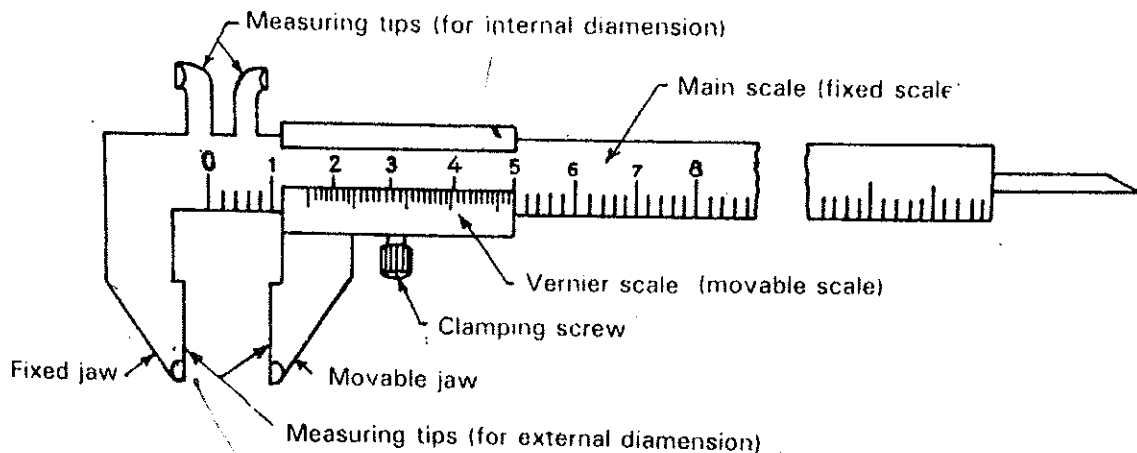
Strength of permanent joint is high. Usually joint strength is same with that of the components.

Repair and replacement are also easy.

Repair and replacement are difficult and costly.

Q13. Draw and Define the Vernier caliper used for measuring?

A.13



Q14. Name the tools Used for sheet Metal working Process?

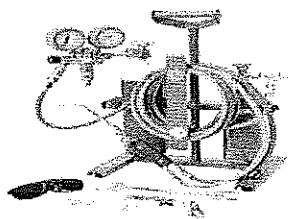


Sr No.	Measuring	Marking	Cutting
1	Steel ruler- for measuring linear	Scribe- deepen marks	Shear Table-
2	Measuring tape	centre punch	notch
3	Feller gauge	prick punch	Pad brake
4	Steel wire and Sheet metal gauge	Grooving stake	Combination snip
5	Angle plate	scriber	Tinner snips Left & Right
6	Combination square	Divider	Circle cutter
7	Try square	Marker	Drill MACHINE
8	Vernier calliper		Drill bit

Section – C

06X04 = 24 Marks

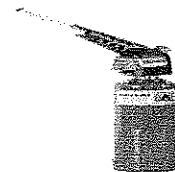
Q15. Draw the neat sketch of brazing setup and label each of the component?



Brazing tool kit



Brazing Nozzle



Brazing tool kit



Filler Material



Heat Deflector

A.15

Q16. Calculate the following Area, Perimeter?

A.16 Triangle with equal sides of 5 cm each

square with side 10 cm

Circle with radius 8 cm

a) A.16 Triangle with equal sides of 2cm each



= Area for equilateral triangle equal to  $= \frac{\sqrt{3}}{4} \times (5\text{cm})^2 = \text{ cm square}$

Perimeter = 3a = 15 cm

b) square with side 10 cm = 10X10=100Sq. Cm

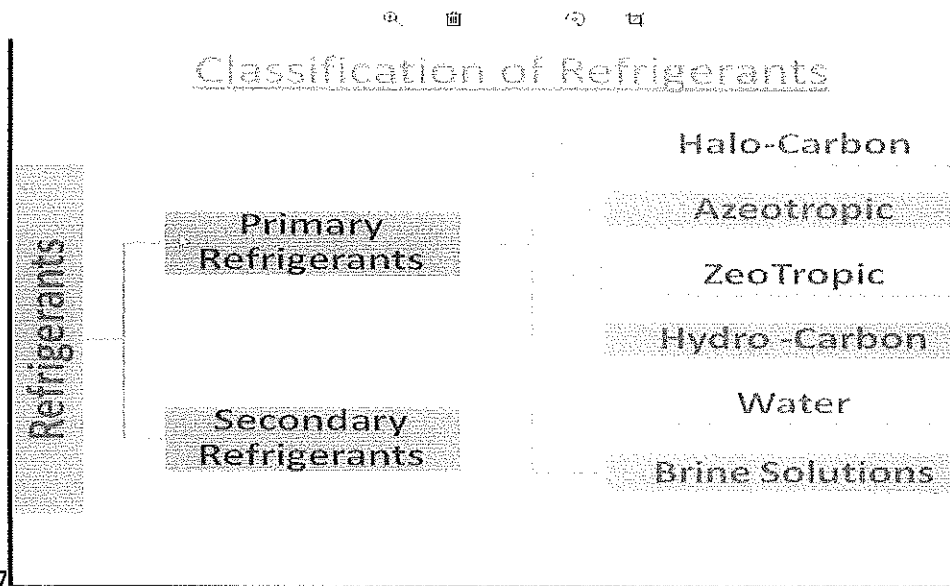
perimeter = 4X10= 40cm

circle =  $\pi \times R^2 = 3.14 \times 64 = 201.46$

perimeter =  $2 \pi R = 2 \times 3.14 \times 6$

=38

Q17. Name and Define the Types of refrigerants?



A.17

Q18. Write in brief about Safety used during welding?

A.18. Welding safety includes the following.

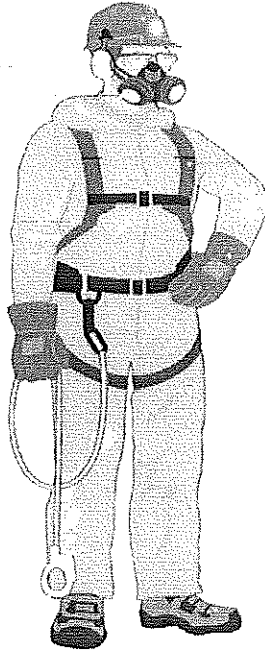
1. safety shoes
2. glass shield
3. Din helmet
4. Leather strips
5. artifical ventilators for fumes exhaust



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Ear defenders  
Masks(respiratory protection)

Special workwear



Helmet

Protective goggles  
(eye protection)

Fall protection  
(safety harness with line)

Gloves

Safety footwear  
(foot protection)

Prof. Hardik Sharma  
Deigh









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Registration No.: .....

School of RAC Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, 1<sup>st</sup> Semester,

End-Sem. Examination

Course Code: RAC1105

Time: 2 Hour

Course Name: RAC Systems Component Testing and performance

Max. Marks: 50

Instruction:

- (1) In section A, write both option and answer

SET-A

Answer sheet

Section – A

01X10 = 10 Marks

1. What is the latent heat of water?  
d. 334 KJ/Kg C
2. What equation represents Boyle's Law?  
c.  $P_1 \times V_1 = P_2 \times V_2$
3. What is equal to 1 TR?  
b. 12000 BTU
4. What is unit of COP?  
d. None of the above.
5. What is equal to 0C (temperature)?  
a. 32 F
6. Which mode of heat can travel through the vacuum?  
c. Radiation
7. What is the reading of the pressure gauge when it is opened to the atmosphere?  
a. 0 PSIG
8. Liquid exerts pressure in  
d. Downward and outward
9. What is density?  
b. Mass/ Volume
10. Specific gravity is density of \_\_\_\_\_ divided by the density of \_\_\_\_\_?  
b. Substance, Water

Section – B

04X4 = 16 Marks

1. What is the definition of refrigeration?



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**Answer:**

A Process of transferring heat from a place where it is objectionable to where it makes little or no difference

Heat naturally flows from a warmer substance to a cooler substance

Heat will flow naturally from a 100°F house if the outside temperature is 80°F

Mechanical refrigeration is needed if house is 80°F and outside temperature is 100°F

2. What is one ton of refrigeration?

**Answer:**

Resort to any text or reading that is correct and you will find the following standards

It takes 144 BTU to melt one pound of ice at 32 degrees Fahrenheit

2,000 pounds (1 ton) of ice will require 288,000 Btu to melt – Formula here is  $144 \times 2000 \text{ lbs} = 288,000 \text{ btu}/24 \text{ hours}$

3. What is the definition of sensible Heat?

**Answer:**

Heat transfer that results in a change in temperature of a substance

Sensible heat transfers can be measured with a thermometer

Example of a sensible heat transfer: Changing the temperature of a sample of water from 68 to 69 degrees F

4. What are temperature and heat, how they are related?

**Answer:**

Heat is the molecular movement of molecules

Heat cannot be created or destroyed

It can be measured

It can be transferred

Heat always moves from warm to cold

Heat always moves from high to low

Heat always moves from positive to negative

## Section – C

04X06 = 24 Marks

1. Write a short note on following

a. Power

**Answer:**

Is the rate at which work is done, Work per unit time is expressed in ft-lbs/min

Rated in Horsepower (HP), 1 HP = 33,000 ft-lbs/min



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Electrical power is measure in watts

1 HP = 746 Watts, 1 Watt = 3.413 Btu's , 1 kw = 3,413 Btu's

b. Charles's Law:

Answer:

$V_1/T_1 = V_2/T_2$ ,  $V_1$  is original volume,  $V_2$  is new volume,  $T_1$  is original temperature

$T_2$  is new temperature, Note that when air is heated it expands, Also used when referring to compressors

2. What are different types of lines in PH chart?

Answer:

a. Temperature lines: This line travel through the PH graph. Under the dome temperature line shows constant pressure because of latent heat for phase change.

b. Pressure lines: Y-axis shows pressure axis, These lines are straight lines perpendicular to the pressure axis.

c. Enthalpy lines: X-axis shows enthalpy axis. These are the straight lines perpendicular to the x-axis.

Entropy lines: We can find entropy lines in superheat region of the graph. These lines are curved lines, start from saturated vapor region and travel to the right side of graph.

d. Specific Volume: - These lines are very thin lines, these line travel through the graph. These lines starts from subcooled and travel towards the super-heated region.

3. VCR cycle runs on R134a, write the step by step procedure to draw a PH chart, assume the required datum.

On the P-H diagram, pressure is indicated on the y-axis and enthalpy is indicated on the x-axis.

Typically enthalpy is in units of Btu/lb and pressure is in units of pounds per square inch (psi). The upside down U figure shown on the diagram designates the points at which the refrigerant changes phase. The left vertical curve indicates the saturated liquid curve and the right vertical curve indicates the saturated vapor curve. The region in between the two curves describe refrigerant states that contain a mixture of both liquid and vapor. The locations to the left of the saturated liquid curve indicate that the refrigerant is in liquid form and locations to the right of the saturated vapor curve indicate that the refrigerant is in vapor form. The point at which the two curves meet is called the critical point. The importance of this point is that at any point above, no additional pressure will change the vapor into a liquid. A simplified pressure-enthalpy diagram is shown below, describing this information.



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- 1) Liquid Region: The liquid region is also known as the subcooled region. In this region there are vertical temperature lines, which increase as enthalpy is increased. Figure 8 is a simplified P-H diagram illustrating the constant temperature lines.
  
- 2) Vapor Region: The vapor region is also known as the superheated region. In this region there are vertical temperature lines, which increase as enthalpy is increased. Refer to Figure 8. There are also lines of constant entropy, which are also important. Entropy is the measure of the amount of disorder in the system.
  
- 3) Liquid-Vapor Mix Region: In this region, the P-H diagram shows horizontal temperature lines, which indicate constant temperature. In this reason liquid and vapour both present according to the temperature and pressure.

4. What are conduction, convection and radiation?

Answer:

- Conduction: Heat travels from one molecule to another within a substance

Heat travels from one substance to another

Not all materials conduct heat at the same rate

Example: Heat will travel through a copper rod from the end that is being heated through to the end of the copper tube

- Convection: Natural convection occurs when heated air rises and cool air takes its place

The best example of this is baseboard heaters installed in your home

They don't use a fan to blow air throughout the home but rather heat air throughout the house

Remember also with this warm air rises and cold air falls

- Radiation: Radiant heat passes through air, heating the first solid object with which it comes in contact

These heated objects, in turn, heat the surrounding area

Radiant heat can travel through a vacuum

Radiant heat can travel through space without heating it

Example of radiation: An electric heater that glows bright red

Example: The sun shining down on the backyard of a residence

*Com*  
*Pr Singh*



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Registration No.: .....

**School of RAC Skills**  
**Session: 2020-21 (Summer Semester)**  
**B. Voc. Program, 1st Semester,**  
**End-Sem. Examination**

**Course Code: RAC1105**

**Time: 2 Hour**

**Course Name: RAC Systems Component Testing and performance**

**Max. Marks: 50**

**Instruction:**

- (1) In section A, write both option and answer

**SET-B**  
**Section – A**

01X10 = 10 Marks

1. What is the specific heat of water?
  - a. 4.2 KJ/Kg
  - b. 334 KJ/Kg
  - c. 4.2 KJ/Kg C
  - d. 334 KJ/Kg C
2. What equation represents Charles's Law?
  - a.  $P_1 \times V_1/T_1 = P_2 \times V_2/T_2$
  - b.  $V_1/T_1 = V_2/T_2$
  - c.  $P_1 \times V_1 = P_2 \times V_2$
  - d. . None of them
3. What is equal to 1 HP?
  - a. 746 W
  - b. 1300 BTU
  - c. 2 HP
  - d. None of the above.
4. What is equal to 1 watt
  - a. 12000 Btu
  - b. 1 HP
  - c. 3.413 Btu's
  - d. None of above
5. Which statement is false
  - a. Warm always moves to cold
  - b. Positive always moves to negative
  - c. Warm air (heat) rises because it is lighter than just air
  - d. None of them
6. Refrigerants – substances that boil at \_\_\_\_\_ pressures and temperatures and condense at \_\_\_\_\_ pressure and temperatures.
  - a. High, Low
  - b. Low, High
  - c. Low, medium
  - d. High, medium
7. R134a used as replacement for
  - a. R22
  - b. R32
  - c. R12
  - d. R707



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8. Saturation temperature: point at which the addition or removal of heat will result in a change of \_\_\_\_\_.

- a. Pressure.
- b. State.
- c. Density
- d. temperature

9. Evaporator absorbs heat by boiling a \_\_\_\_\_ temperature liquid into a \_\_\_\_\_ temperature vapor

- a. High , Low
- b. Low. High
- c. Low, Low
- d. High, High

10. Superheating is the heating of a \_\_\_\_\_ above its saturation \_\_\_\_\_.

- a. vapour, Pressure
- b. Liquid, Temperature
- c. vapour, Temperature
- d. Liquid, pressure

## Section – B

04X04 = 16 Marks

1. What is COP?
6. What are pressure and enthalpy, also define relation between them?
7. What is the definition of specific heat?
8. What is a heat-pump?

## Section – C

04X06 = 24 Marks

1. Write a short note on following
  - (a) Energy
  - (b) Power
9. What are different component of VCR system, explain briefly?
10. Write a short note on PH chart.
11. What are required properties of a refrigerant?

Ram  
Singh



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of RAC Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, 1st Semester,

End-Sem. Examination

Course Code: RAC1105

Time: 2 Hour

Course Name: RAC Systems Component Testing and performance

Max. Marks: 50

Instruction:

- (1) In section A, write both option and answer

SET-B

Section – A

*Answer key*

01X10 = 10 Marks

1. What is the specific heat of water?  
c. 4.2 KJ/Kg C
2. What equation represents Charles's Law?  
b.  $V_1/T_1 = V_2/T_2$
3. What is equal to 1 HP?  
a. 746 W
4. What is equal to 1 watt  
c. 3.413 Btu's
5. Which statement is false  
a. None of them
6. Refrigerants – substances that boil at \_\_\_\_\_ pressures and temperatures and condense at \_\_\_\_\_ pressure and temperatures.  
b. Low, High
7. R134a used as replacement for  
C. R12
8. Saturation temperature: point at which the addition or removal of heat will result in a change of \_\_\_\_\_.  
b. State.
9. Evaporator absorbs heat by boiling a \_\_\_\_\_ temperature liquid into a \_\_\_\_\_ temperature vapor.  
c. Low, Low
10. Superheating is the heating of a \_\_\_\_\_ above its saturation \_\_\_\_\_.  
c. vapour, Temperature

Section – B

Page 1 of 5



1. What is COP?

Answer:

The coefficient of performance or COP of a heat pump, refrigerator or air conditioning system is a ratio of useful heating or cooling provided to work required. The COP usually exceeds 1, especially in heat pumps, because, instead of just converting work to heat pumps additional heat from a heat source to where the heat is required. COP is highly dependent on operating conditions, especially absolute temperature and relative temperature between sink and system

2. What are pressure and enthalpy, also define relation between them?

Pressure, in the physical sciences, the perpendicular force per unit area, or the stress at a point within a confined fluid. The pressure exerted on a floor by a 42-pound box the bottom of which has an area of 84 square inches is equal to the force divided by the area over which it is exerted.

Enthalpy, the sum of the internal energy and the product of the pressure and volume of a thermodynamic system. Enthalpy is an energy-like property or state function—it has the dimensions of energy (and is thus measured in units of joules or ergs), and its value is determined entirely by the temperature, pressure, and composition of the system and not by its history. In symbols, the enthalpy,  $H$ , equals the sum of the internal energy,  $E$ , and the product of the pressure,  $P$ , and volume,  $V$ , of the system:  $H = E + PV$ .

3. What is the definition of specific heat?

Answer:

Defined as number of Btu's required to raise the temperature of 1lb of water 1 degree Fahrenheit

Specific heat of water is 1.00BTU

Specific heat of ice is .50

Specific heat of steam is .50

Specific heat of air is .24

4. What is a heat-pump?

Answer:

Heat pumps transfer heat by circulating a substance called a refrigerant through a cycle of evaporation and condensation. A compressor pumps the refrigerant between two heat exchanger coils. In one coil, the refrigerant is evaporated at low pressure and absorbs heat from its surroundings



1. Write a short note on following

(a) Energy

Answer:

In HVAC we use electrical energy to drive the main components of AC and Heating systems

Energy cannot be created or destroyed

It can be converted from one type to another

Heat energy provides comfort heating and flows from warm to cold

Electrical energy is purchased from utility companies by the KWh, fuel oil by the gallon, and gas by the cubic foot

(b) Power

Answer:

Is the rate at which work is done

Work per unit time is expressed in ft-lbs/min

Rated in Horsepower (HP)

1 HP = 33,000 ft-lbs/min

Electrical power is measure in watts

1 HP = 746 Watts

1 Watt = 3.413 Btu's

1 kw = 3,413 Btu's

2. What are different component of VCR system, explain briefly?

STEP 1: COMPRESSION

The refrigerant (for example R-717) enters the compressor at low temperature and low pressure. It is in a gaseous state. Here, compression takes place to raise the temperature and refrigerant pressure. The refrigerant leaves the compressor and enters to the condenser. Since this process requires work, an electric motor may be used. Compressors themselves can be scroll, screw, centrifugal or reciprocating types.

STEP 2: CONDENSATION

The condenser is essentially a heat exchanger. Heat is transferred from the refrigerant to a flow of water. This water goes to a cooling tower for cooling in the case of water-cooled condensation. Note that seawater and air-cooling methods may also play this role. As the refrigerant flows through the condenser, it is in a constant pressure.

STEP 3: THROTTLING AND EXPANSION

When the refrigerant enters the throttling valve, it expands and releases pressure.

Consequently, the temperature drops at this stage. Because of these changes, the



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refrigerant leaves the throttle valve as a liquid vapor mixture, typically in proportions of around 75 % and 25 % respectively.

## STEP 4: EVAPORATION

At this stage of the Vapor Compression Refrigeration Cycle, the refrigerant is at a lower temperature than its surroundings. Therefore, it evaporates and absorbs latent heat of vaporization. Heat extraction from the refrigerant happens at low pressure and temperature. Compressor suction effect helps maintain the low pressure.

3. Write a short note on PH chart.

Answer:

On the P-H diagram, pressure is indicated on the y-axis and enthalpy is indicated on the x-axis. Typically enthalpy is in units of Btu/lb and pressure is in units of pounds per square inch (psi). The upside down U figure shown on the diagram designates the points at which the refrigerant changes phase. The left vertical curve indicates the saturated liquid curve and the right vertical curve indicates the saturated vapor curve. The region in between the two curves describe refrigerant states that contain a mixture of both liquid and vapor. The locations to the left of the saturated liquid curve indicate that the refrigerant is in liquid form and locations to the right of the saturated vapor curve indicate that the refrigerant is in vapor form. The point at which the two curves meet is called the critical point. The importance of this point is that at any point above, no additional pressure will change the vapor into a liquid. A simplified pressure-enthalpy diagram is shown below, describing this information.

1) Liquid Region: The liquid region is also known as the subcooled region. In this region there are vertical temperature lines, which increase as enthalpy is increased. Figure 8 is a simplified P-H diagram illustrating the constant temperature lines.

(2) Vapor Region: The vapor region is also known as the superheated region. In this region there are vertical temperature lines, which increase as enthalpy is increased. Refer to Figure 8. There are also lines of constant entropy, which are also important. Entropy is the measure of the amount of disorder in the system.

(3) Liquid-Vapor Mix Region: In this region, the P-H diagram shows horizontal temperature lines, which indicate constant temperature. In this reason liquid and vapour both present according to the temperature and pressure.

4. What are required properties of a refrigerant?

Answer:

Thermodynamic Properties:



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- (i) Low boiling point
- (ii) Low freezing point
- (iii) Positive pressures (but not very high) in condenser and evaporator.
- (iv) High saturation temperature
- (v) High latent heat of vapourization

## 2. Chemical Properties:

- (i) Non-toxicity
- (ii) Non-flammable and non-explosive
- (iii) Non-corrosiveness
- (iv) Chemical Stability in reacting
- (v) No effect on the quality of stored (food and other) products

## 3. Physical Properties:

- (i) Low specific volume of vapour
- (ii) Low specific heat
- (iii) High thermal conductivity
- (iv) Low viscosity
- (v) High electrical insulation

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