SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, New Delhi / Affiliated to Anna University, Chennai / Accredited by NAAC)

Dindigul – Palani Highway, Dindigul – 624 002

DEPARTMENT OF MECHANICAL ENGINEERING

Value Added Courses Summary 2018-2019

Course Name	Refrigeration and Air Conditioning
Course Duration	30 hours
Year offered	II year Mechanical Students
Course Instructors	Mr.S.Srinivasan, Professor/Mech. Engg, SSMIET Dindigul
Course Outcome	1. Students should be able to prepare and communicate technical reports related to RAC system designs. 2. Students should be able to understand the specific requirements and applications of refrigeration in commercial settings. 3. Students should be capable of understanding Engineer's responsibility to ensure safe and effective RAC systems. 4. Students should be able to understand the functions and types of major components in RAC systems..
Course Type	Self Framed
Assessment Mode	
Attendance	30 hours
Number of Participants	20
Scheme of Exam	Evaluation test through offline mode

DEPT. OF MECHANICAL ENGG. SSMIET, DINDIGUL

Course Coordinator

HoD/Mech.Engg

SSM Institute of Engineering and Technology DINDIGUL-624 002

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Palani Road, Dindigul

"Hands on Training in Refrigeration and Airconditioning"

Value Added Course

Academic Year (2018-2019) Odd Semester

Total hours: 30 Hours

16.07.2018- 03.08.2018

Department of Mechanical Engineering

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Course Coordinators :

1. Mr. S. Srinivasan,
2. Ms. D. Anitha.

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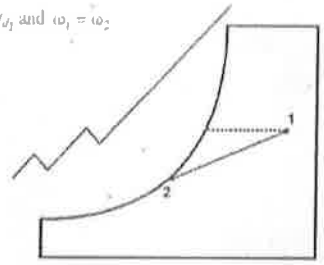
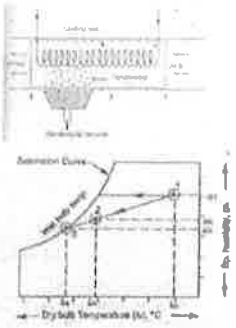
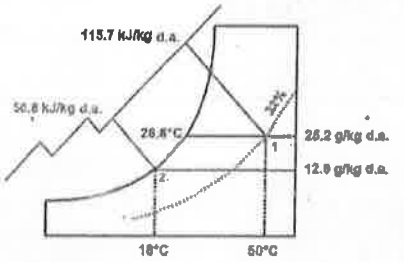
Cooling and Dehumidifying ...



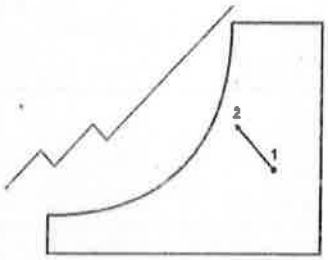
Cooling and Dehumidifying ...



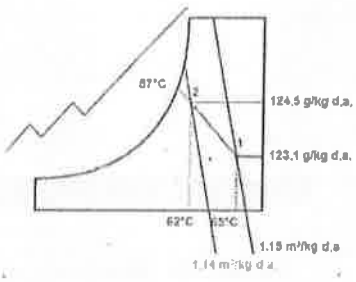
Cooling and Dehumidifying ...



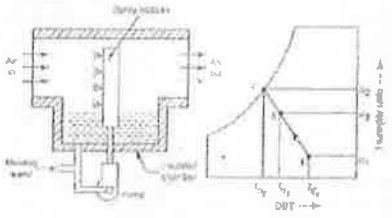
Adiabatic or Evaporative Cooling



Adiabatic or Evaporative Cooling ...



Adiabatic evaporative cooling -For cooling and humidification



$$\text{Effectiveness} = \frac{\text{Actual drop in dry bulb temperature}}{\text{Ideal drop in dry bulb temperature}} = \frac{t_{a_1} - t_{a_2}}{t_{a_1} - t_{w_1}}$$

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DEPARTMENT OF MECHANICAL ENGINEERING

CIRCULAR

10.07.2018

We have planned to conduct the **Refrigeration and Air Conditioning (R&AC)** training program for II Year Mechanical Engineering students from 16.07.2018 onwards. The course will be handled by Mr.S.Srinivasan, AP/Mech, and Ms.D.Anitha, AP/Mech. The interested students are asked to register their names with Ms.D.Anitha, AP/Mech on or before 14.07.2018.

Details about the program

No. of Students to be admitted	: 30
Selection Process	: First come first basis
Duration of the program	: 15 days / 30 hours.
Timing	: 4.30 pm to 6.30 pm

Attendance for the above program is compulsory.

10.7.18
10/7/18

COORDINATORS

[D. ANITHA]

[S. SRINIVASAN]

10/7/18

HOD/MECH

PRINCIPAL

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Department of Mechanical Engineering

06.07.2018

Submitted To Principal

Respected sir,

Sub: Proposal for conducting value added course **(Refrigeration and air conditioning)** – Reg.

We have planned to conduct the training program on "**Refrigeration and air conditioning**" for II year Mechanical Engineering students. We assure that this will be very useful for the students to enhance their knowledge in the field of Thermal Engineering.

Your approval is requested to conduct this program.

Thanking you

Course coordinators
D.ANITHA, AP/Mech,
S.SRINIVASAN ,AP/Mech,

HoD/MECH

PRINCIPAL

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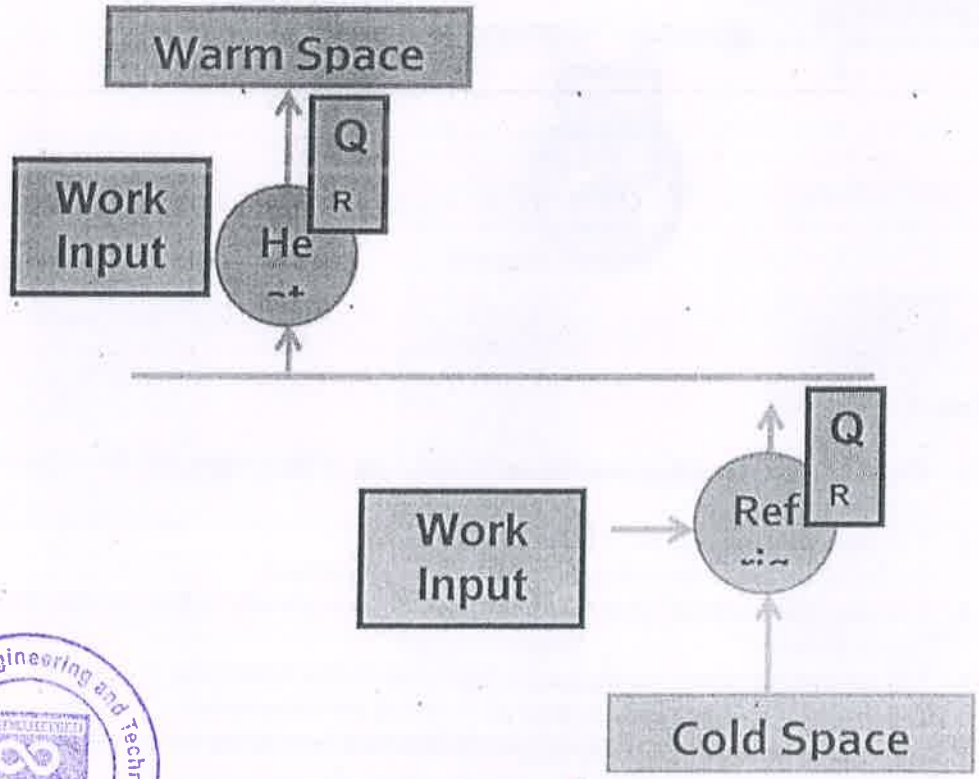
Unit V

Refrigeration and Air-conditioning

Refrigeration : It is defined as the process of providing and maintaining a temperature well below that of surrounding atmosphere. In other words refrigeration is the process of cooling substance.

Refrigerator and Heat Pump:

If the main purpose of the machine is to cool some object, the machine is named as refrigerator.
If the main purpose of machine is to heat a medium warmer than the surroundings, the machine is termed as heat pump



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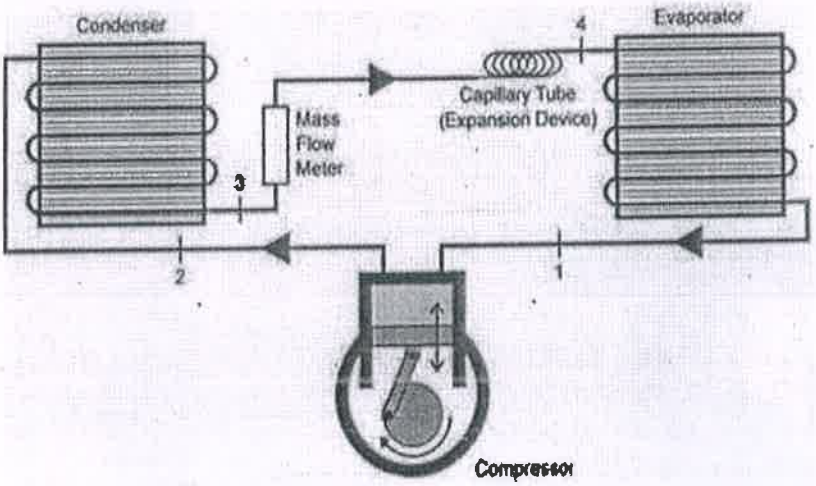
Applications of Refrigeration :

- In chemical industries, for separating and liquefying the gases.
- In manufacturing and storing ice.
- For the preservation of perishable food items in cold storages.
- For cooling water.
- For controlling humidity of air manufacture and heat treatment of steels.
- For chilling the oil to remove wax in oil refineries.
- For the preservation of tablets and medicines in pharmaceutical industries.
- For the preservation of blood tissues etc.,
- For comfort air conditioning the hospitals, theatres, etc.,

Vapour Compression Refrigeration system :



Working :

1. The low pressure refrigerant vapour coming out of the evaporator flows into the compressor.
2. The compressor is driven by a prime mover.
3. In the compressor the refrigerant vapour is compressed.
4. The high pressure refrigerant vapour from the compressor is then passed through the condenser.
5. The refrigerant gives out the heat it had taken in the evaporator (N)
6. The heat equivalent of work done on it (w) on the compressor.
7. This heat is carried by condenser medium which may be air or water.
8. The high pressure liquid refrigerant then enters the expansion valve.
9. This valve allows the high pressure liquid refrigerant to flow at a controlled rate into the evaporator.
10. While passing though this valve the liquid partially evaporates.

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solution returning from the generator to the absorber.

6. In the generator the warm solution is further heated by steam coils, gas or electricity and the ammonia vapour is driven out of solution.
7. The boiling point of ammonia is less than that of water.
8. Hence the vapours leaving the generator are mainly of ammonia.
9. The weak ammonia solution is left in the generator is called weak aqua.
10. This weak solution is returned to the absorber through the heat exchanger.
11. Ammonia vapours leaving the generator may contain some water vapour.
12. If this water vapour is allowed to the condenser and expansion valve, it may freeze resulting in chocked flow.
13. Analyser and rectifiers are incorporated in the system before condenser.
14. The ammonia vapour from the generator passes through a series of trays in the analyser and ammonia is separated from water vapour.
15. The separated water vapour returned to generator.
16. Then the ammonia vapour passes through a rectifier.
17. The rectifier resembles a condenser and water vapour still present in ammonia vapour condenses and the condensate is returned to analyser.
18. The virtually pure ammonia vapour then passes through the condenser.
19. The latent heat of ammonia vapour is rejected to the cooling water circulated through the condenser and the ammonia vapour is condensed to liquid ammonia.
20. The high pressure liquid ammonia is throttled by an expansion valve or throttle valve.
21. This reduces the high temperature of the liquid ammonia to a low value and liquid ammonia partly evaporates.
22. Then this is led to the evaporator.
23. In the evaporator the liquid fully vaporizes
24. The latent heat of evaporation is obtained from the brine or other body which is being cooled.
25. The low pressure ammonia vapour leaving the evaporator again enters the absorber and the cycle is completed.
26. This cycle is repeated again to provide the refrigerating effect.

Application of Refrigeration system :

- Preservation of food items like vegetables, milk and eggs.
- Preservation of medicines.
- Preservation of blood, tissues, etc.,
- Preservation and cooling of cool drinks.
- Preservation of chemicals (Chemical industries)
- Cooling of water.
- Industrial and comfort airconditioning.
- Processing of dairy products.

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AIRCONDITIONING

Air-conditioning : Air Conditioning is the process of conditioning the air according to the human comfort, irrespective of external conditions.

Applications of Air Conditioning

- Used in offices, hotels, buses, cars.,etc
- Used in industries having tool room machines.
- Used in textile industries to control moisture.
- Used in printing press.
- Used in Food industries, Chemical plants.

Air conditioning systems are classified as

1) According to the purpose

a) Comfort Air conditioning.
b) Industrial Air conditioning.

2) According to Season of the year

a) Summer Air conditioning.
b) Winter Air conditioning.
c) Year round Air conditioning

Types of Air conditioners

a) Room Air conditioners
b) Winter Air conditioners
c) Central Air conditioners

Functions of Air conditioners

a) Cleaning air.
b) Controlling the temp of air.
c) Controlling the moisture content.
d) Circulating the air.

Important Definitions :

1) Dry air: The atmospheric air which no water vapour is called dry air.

2) Psychrometry: Psychrometry is the study of the properties of atmospheric air.

3) Temperature: The degree of hotness (or) Coldness is called the temperature.

4) Moisture: Moisture is the water vapour present in the air

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Working :

- The low pressure vapour refigerant from the evaporator is sucked by compressor through the open inlet valve.
- The compressor compresses the vapour refrigerant.
- The high pressure and high temperature vapour refrigerant then flows to the condenser through the open outlet valve.
- In the condenser, the outside atmospheric temperature in summer being around 42o C, air is circulated by fan.
- After condensation, the high pressure liquid refrigerant formed passes through an expansion valve which reduces its pressure
- The low pressure refrigerant then enters the evaporator and evaporates, thus absorbing latent heat of vapourisation from the room air.
- The equipment which is used for evaporating the refrigerant is called evaporator.
- After evaporation, the refrigerant becomes vapour.
- The low pressure vapour is again passed to the compressor. Thus the cycle is repeated.
- A partition separates high temperature side of condenser, compressor and low temperature side of evaporator
- The quantity of air circulated can be controlled by the dampers.
- 10. The moisture in the air passing over the evaporator coil is dehumidified and drips into the trays.
- The unit automatically stops when the required temperature is reached in the room. This is accomplished by the thermostat and control panel.
- Generally, the refrigerant monochloro diluloro mehane (CHCLF2) is used in air conditioner. It is called Freon 22.

Merits and Demerits of Window type air conditioner

Merits :

- A separate temperature control is provided in each room.
- Ducts are not required for distribution.
- Cost is less.
- Skilled technician is required for installation.

Demerits:

- It makes noise.
- Large hole is made in the external wall or a large opening to be created in the window panel. This leads to insecurity to inmates.
- Air quantity cannot be varied.

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- The hot refrigerant vapour is passed to the compressor and then to the condenser where it becomes liquid.
- Thus the cycle is repeated.
- A thermostat is used to keep the room at a constant, comfortable temperature avoiding the frequent turning on off.

Merits and Demerits of Split type air conditioner :

Merits :

- It is compact
- Upto four indoor AHU's may be connected to one outdoor unit.
- It is energy and money saving.
- Duct is not used.
- Easier to install.
- It is noiseless, because rotary air compressor used is, kept outside.
- It is more efficient and powerful.
- It has the flexibility for zoning.

Demerits :

- Initial cost is higher than window air conditioner
- Skilled technician is required for installation.
- Each zone or room requires thermostat to control the air cooling

Applications of airconditioning :

- Used in houses, hospitals, offices, computer centres, theatres, departmental stores etc.,
- Air-conditioning of transport media such as buses, cars trains, aeroplanes and ships.
- Wide application in food processing, printing, chemical, pharmaceutical and machine tool, etc.,

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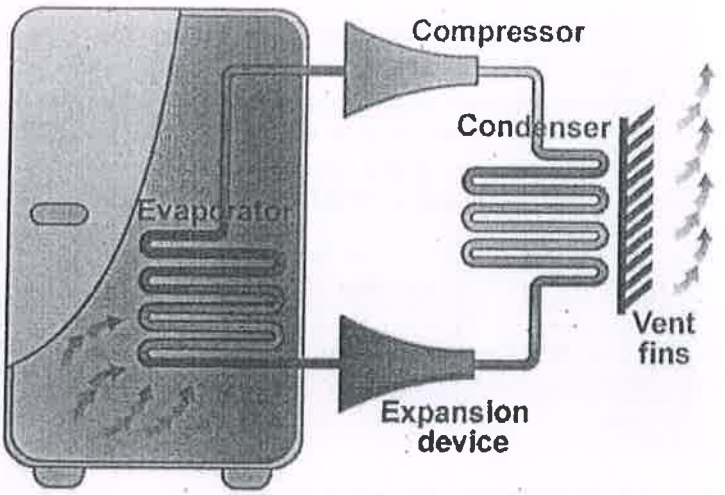

Ref: GKV/5.12-3

An NH_3 refrigerator produces 30tons of ice from and at 0°C in a day of 24hours. The temperature range in the compressor is from 25°C to –15°C. The vapour is dry saturated at the end of compression. Assume a COP 60% theoretical. Calculate the power required to drive the compressor. Assume latent heat of ice is 335kJ/kg. For properties of NH_3 refer table or charts. *[MU - Oct. '98]*

Temperature °C	h_f (kJ/kg)	h_g (kJ/kg)	s_f (kJ/kgK)	s_g (kJ/kgK)
25	298.9	1465.8	1.124	5.039
-15	112.34	1426.5	0.4572	5.549

Ans: Power = 12.4kW

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Ref: GKV/5.15-4

A refrigerating plant using R134a as refrigerant works between 25°C and –5°C. The dryness fraction of R134a is 0.85 at the entry of compressor. 8kg/min of R134a is circulated through the system. Ice is formed at 0°C from the water at 15°C. Calculate the actual COP and the ice formed per day if the relative efficiency is 45%. C_p(water) = 4.187kJ/kgK, h_{fg}(water) = 335kJ/kg. For properties refer the table as given below:

Temperature °C	h_f(kJ/kg)	h_g(kJ/kg)	s_f(kJ/kgK)	s_{fg}(kJ/kgK)
25	133.89	175.14	1.1176	0.5875
5	93.46	198.31	0.976	0.7395

Ans: Ice formed per day = 1.7 tonnes

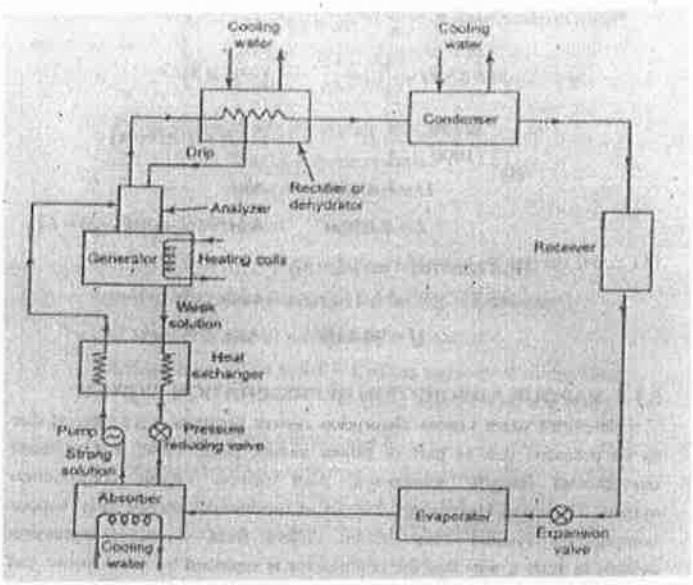
Ref: GKV/5.28-9

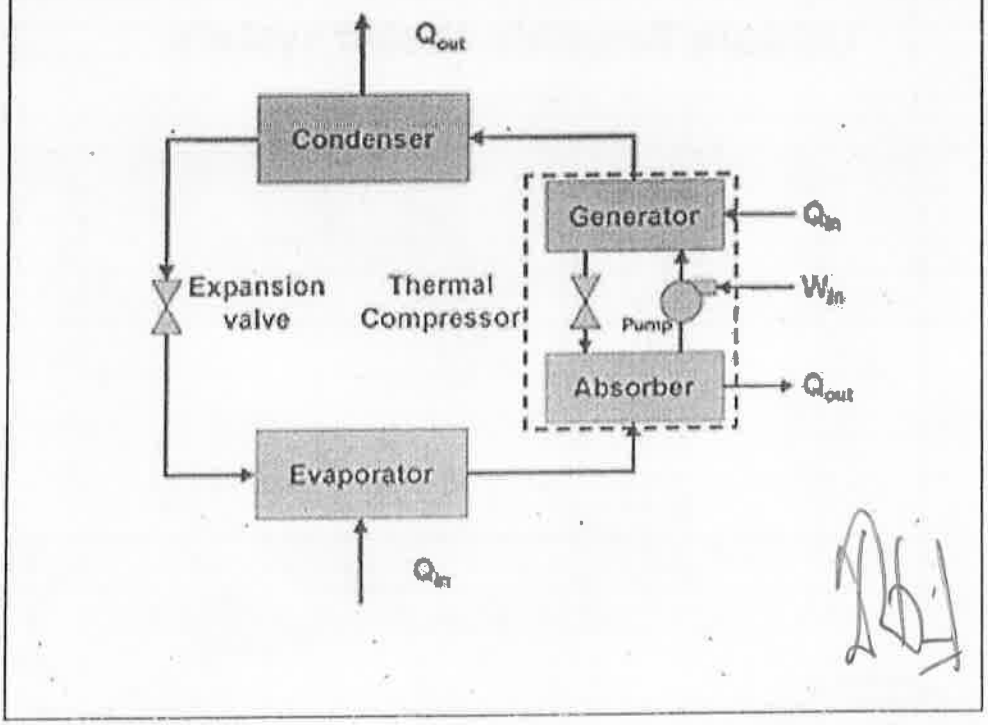
A vapour compression refrigeration plant works between pressure limits of 5.3bar and 2.1bar. The vapour is super heated at the end of compression, its temperature being 37°C. The vapour is super heated by 5°C before entering the compressor. If the specific heat of super heated vapour is 0.63kJ/kgK. Find the co- efficient of performance of the plant. Use the data given below. [MU Apr.'96]

Pressure (bar)	Saturation Temperature °C	Liquid Heat kJ/kg	Latent Heat kJ/kg
5.3	15.5	56.15	144.9
2.1	-14.0	25.12	158.7

Ans: COP= 4.73

Vapour Absorption Refrigeration system (VAR)

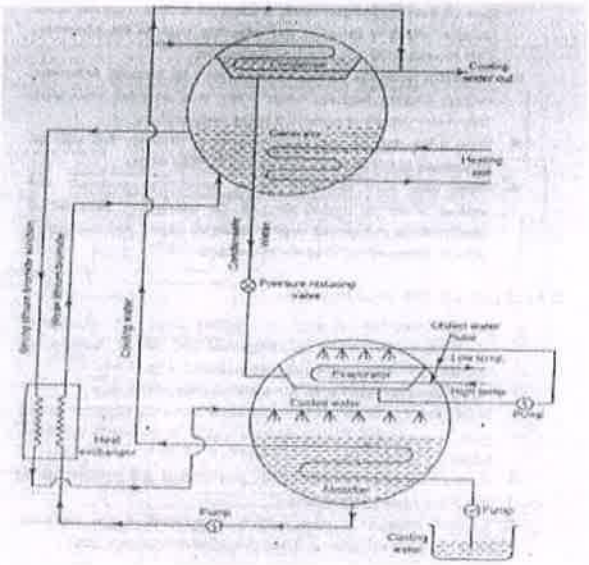




VCR Vs VAR

Sl. No.	Vapour compression system	Vapour absorption System
1.	Electric Power is needed to drive the system.	No need of electric power.
2.	Wear and tear is more because of moving components.	Wear and Tear is less.
3.	Tonne capacity is low.	Tonne capacity is high.
4.	Charging of refrigerant is simple	Charging of refrigerant is difficult.
5.	More chances for leakage of refrigerant.	There is no leakage of refrigerant.
6.	Mechanical energy is supplied	Heat energy is supplied
7.	Performance at part load is poor.	At part loads, the performance is not affected.
8.	Space requirement is more.	Space requirement is less.
9.	Energy requirement is low.	Energy requirement is high.

Lithium Bromide-Water system



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References

1. http://energy.sdsu.edu/testhome/vtAnimations/animations/chapter10/A-vaporCompress/vaporCompCycle.html

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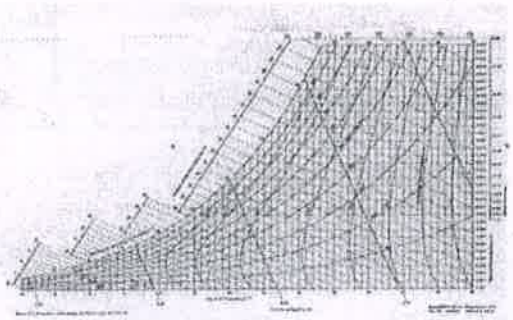
Atmospheric air

- Atmospheric air is not completely dry but a mixture of dry air and water vapor.
- In atmospheric air, the content water vapor varies from 0 to 3% by mass.
- The processes of air-conditioning and food refrigeration often involve removing water from the air (dehumidifying), and adding water to the air (humidifying).

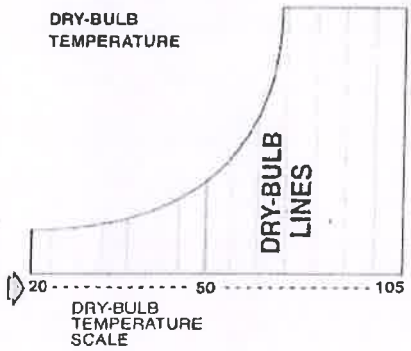
- **Dry air**
  - Air without moisture or water vapour
- **Moist air**
  - Mixture of dry air and water vapour
- **Saturation capacity of air**
  - The maximum quantity of water vapour present in the air at particular air temperature

Psychrometric chart



Dry bulb temperature (t_d)

- Dry bulb temperature is the temperature of the air, as measured by an ordinary thermometer.
- The temperature of water vapor is the same as that of the dry air in moist air.
- Such a thermometer is called a dry-bulb thermometer in psychrometry, because its bulb is dry.



Wet bulb temperature (WBT - t_w)

- It is the temperature of air measured by a thermometer when its bulb is covered with the wet cloth and is exposes to a current rapidly moving air.

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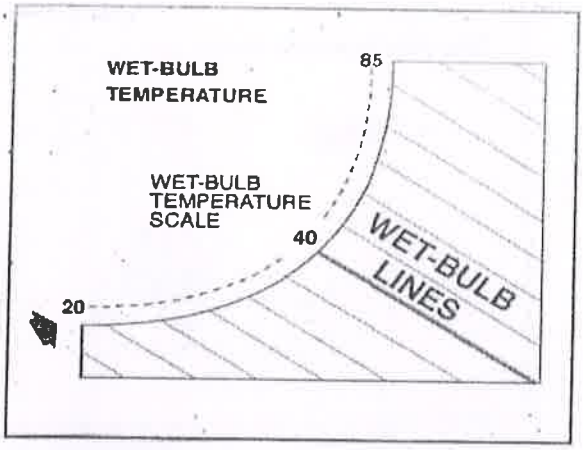
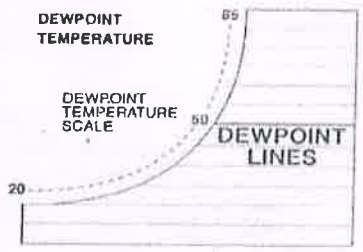


- **Wet bulb depression (WBD)**
  - WBT = DBT – WBT
- **Due point temperature (DPT - t_{dp})**
  - the temperature at which the water present in air begins to condense when air is cooled.
  - For saturated air, DBT, WBT & DPT are all same
- **Due point depression (DPD)**
  - DPD = DBT – DPT

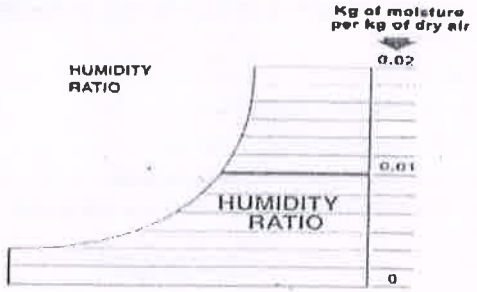
- **Specific humidity / humidity ratio / moisture content**
  - Mass of water vapour present in one kg of dry air.
  - Ratio of mass of water vapour to the mass of dry air in a given volume of moisture.
  - $\acute{\omega} = \frac{0.622 P_v}{P_b - P_v}$
  - P_v, P_a = Partial pressure of water vapour and dry air
  - $p_a V = m_a R_a T$ / $p_v V = m_v R_v T$
  - P_b – barometric pressure

- **Degree of saturation / percentage saturation / saturation ratio (μ)**
  - The ratio of specific humidity of the moist air to the specific humidity of saturated air at the same temperature.
  - $\mu = \acute{\omega} / \acute{\omega}$
  - $\mu = \frac{P_v}{P_s}\left[\frac{P_b - P_s}{P_b - P_v}\right]$

Due point temperature (DPT - t_{dp})



Specific humidity / humidity ratio / moisture content



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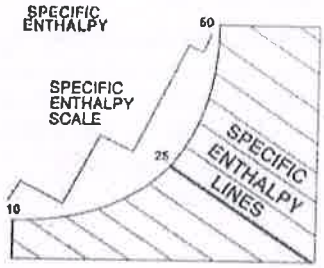
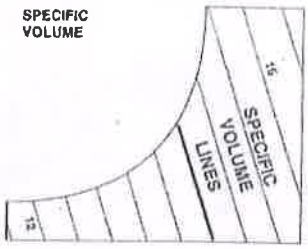
Specific enthalpy lines



Specific volume lines



Relative humidity

- Ratio between actual mass of water vapour in a given volume to the saturated mass of water in same volume and temperature.

$$\Phi = \frac{mass\ of\ water\ vapor\ in\ given\ volume}{saturated\ mass\ of\ water\ vapour\ in\ same\ volume\ of\ temperature}$$

Total enthalpy

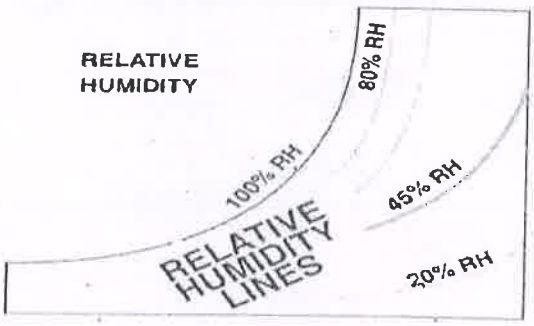
- Total enthalpy of moist air is the sum of the enthalpy of dry air and the enthalpy of water vapour associated with the dry air.
- $H = C_p t_d + \acute{\omega} h_g$
  - C_p = Specific heat at constant pressure = 1.005 kJ/kgK
  - t_d = dry bulb temperature
  - $\acute{\omega}$ = specific humidity
  - h_g = specific enthalpy of air corresponding to DBT.

Dalton's law of partial pressure

- The total pressure exerted by air and water vapour mixture is equal to the barometric pressure
- $P_b = P_a + P_v$
  - P_b = barometric pressure
  - P_a = partial pressure of dry air
  - P_v = partial pressure of water vapour
  - P_{sw} = Saturation pressure corresponding to WBT

$$P_v = P_{sw} = \frac{(P_b - P_{sw})(t_d - t_w)}{1527.4 - 1.3 t_w}$$

Relative humidity lines



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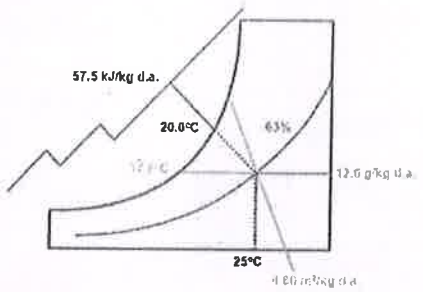
Psychrometric chart ...



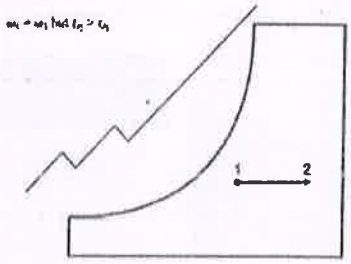
Air conditioning process

1. Sensible heating process
2. Sensible cooling process
3. Humidification process
4. Dehumidification process
5. Heating and humidification process
6. Cooling and dehumidification process
7. Adiabatic mixing air streams process
8. Evaporative cooling process.

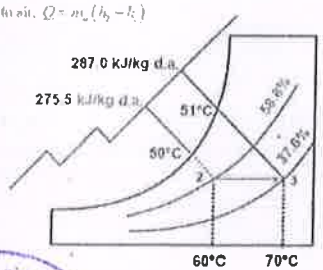
Bypass factor

- The efficiency of heating coil is measured in terms of by pass factor.
- By pass factor is defined as the portion of the air that passes through the coil without contacting the coil surface.
- It is denoted by BPF.

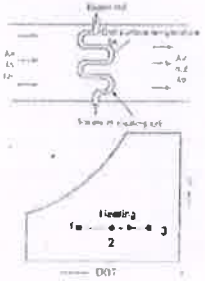
Sensible heating



Sensible heating ...



Sensible heating ...



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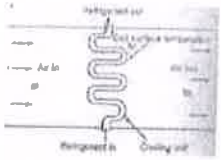
Sensible cooling



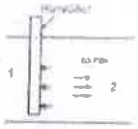
$t_{d_1} > t_{d_2}$ and $\omega_1 = \omega_2$

$$BPF = \frac{t_{d_2} - t_{d_3}}{t_{d_1} - t_{d_3}}$$

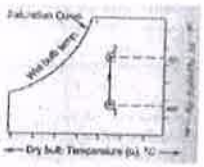
$t_{d_1} < t_{d_2} < t_{d_3}$

$Q = m_a(h_1 - h_2)$

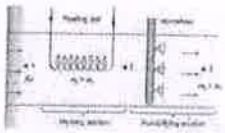
Humidification process



$Q = m_a(h_2 - h_1)$



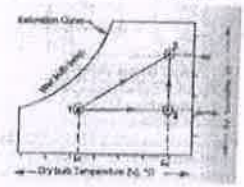
Heating and humidifying



$TH\Sigma$ = Sensible heat load, $SH\Sigma$ + Latent heat load, $LH\Sigma$

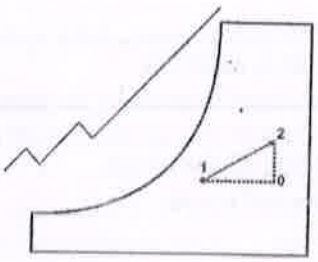
$SH\Sigma = (h_2 - h_1) = (h_3 - h_4)$

The ratio of sensible heat load to the total heat load is known as sensible heat factor or sentable heat ratio (SHF).

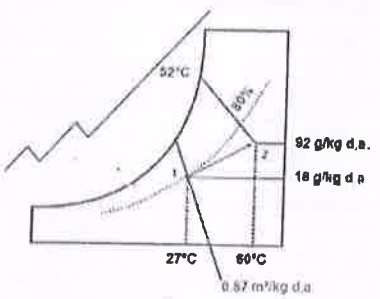


$$SHF = \frac{SH\Sigma}{SH\Sigma + LH\Sigma} = \frac{h_2 - h_1}{(h_2 - h_1) + (h_3 - h_4)}$$

Heating and humidifying ...



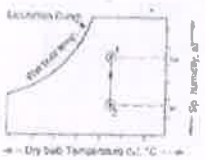
Heating and humidifying ...



Dehumidification process

Latent heat load, $Q = m_a(h_1 - h_2)$

$\omega_1 > \omega_2$, $\phi_1 > \phi_2$ but $t_{d_1} = t_{d_2}$



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Department of Mechanical Engineering

Value added course on **"Refrigeration and Air conditioning"**

Attendance Sheet

Sl. No.	Year & Section	Register No	Name of the Student	16.07.18	17.07.18	18.07.18	19.07.18	20.07.18	23.07.18	24.07.18	25.07.18	26.07.18	27.07.18	30.07.18	31.07.18	01.08.18	02.08.18	03.08.18	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	II - Mechanical - A	922117114030	Grace A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
2	II - Mechanical - A	922117114027	Ethiraj Yogesh P	/	/	/	/	/	/	/	/	A	A	/	/	/	/	/	
3	II - Mechanical - A	922117114026	Essaki Durai Pandi M	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
4	II - Mechanical - A	922117114037	Hari krishnan S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
5	II - Mechanical - A	922117114014	Bharathi Dasan A	/	/	/	/	A	/	/	/	/	/	/	/	/	/	/	
6	II - Mechanical - A	922117114038	Hari vignesh N	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
7	II - Mechanical - A	922117114019	Deepakraj T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
8	II - Mechanical - A	922117114032	Gunasekar S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
9	II - Mechanical - A	922117114031	Gunakaran C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
10	II - Mechanical - A	922117114012	Ashley sachin A	/	/	/	A	/	/	/	A	/	/	/	/	/	/	/	
11	II - Mechanical - A	922117114006	Arul selvan K	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
12	II - Mechanical - A	922117114007	Arun kumar E	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
13	II - Mechanical - A	922117114008	Arun kumar M	/	/	/	/	/	/	/	/	/	/	/	/	A	A	A	
14	II - Mechanical - A	922117114021	Devarajan A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
15	II - Mechanical - A	922117114024	Dinesh kumar M	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
16	II - Mechanical - A	922116114061	Arun kumar M	/	/	/	/	/	/	/	/	/	/	/	/	/	A	/	
17	II - Mechanical - A	922117114025	Divya dharshini K	/	/	/	/	/	/	/	/	/	A	/	/	A	/	/	
18	II - Mechanical - A	922117114002	AFZALIBRAHIM M	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
20	II - Mechanical - A	922117114034	Hariharan S K	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	
21	II - Mechanical - A	922117114035	Hariharan N	/	/	/	A	/	/	A	A	/	A	/	/	/	/	/	
			No. Of Absentees	0	0	0	2	1	0	1	2	1	3	0	0	2	2	1	
			Signature of the Course Instructor																

Coordinator
[S.SRIKIVASAN]

Head of the Department
30/10/18

Principal

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 30/10/18

NAME OF THE STUDENT	K. ARUL SELVAM
YEAR	II Year
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 03.08.18

NAME OF THE STUDENT	ARUN kumar. M
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON R&AC

(16.07.18)

FEED BACK FORM

DATE: _____

NAME OF THE STUDENT	K. Divya dharshini.
YEAR	II nd year.
CONTACT NO./ EMAIL	8838701002 / divyadharshinik28102@gmail.com

1. Course objective and scope in the industry (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 03.08.18

NAME OF THE STUDENT	Hari krishnan . S
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✓ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✓ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor
4. Usefulness (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✓ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor

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6. Exercises given (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
7. Time for Interaction (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
8. Simplification of the concepts and practice (Please put ✔ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor
9. Overall performance of the trainer as a leader (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
10. Rank the Workshop (Please put ✔ mark)	☑ (5) Excellent ☐ (3) Good ☐ (2) Average ☐ (0) Poor
Comments / Suggestions (if any)	

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Signature of the Student

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON R&AC

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FEED BACK FORM

DATE: 25.10.2018.

NAME OF THE STUDENT	A. GRACE
YEAR	II Year
CONTACT NO./ EMAIL	9600310081 / graceaaruljeyaraj@gmail.com

1. Course objective and scope in the industry (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✓ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✓ mark)	☐ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✓ mark)	☐ Excellent ☐ Good ☐ Average ☐ Poor

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

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FEED BACK FORM

DATE: 3.8.18

NAME OF THE STUDENT	Essaki Durai Pandi . M
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 3-8-18

NAME OF THE STUDENT	N. Hari Vignesh
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor.
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor

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S.S.M. Engineering and Technology
DINDIGUL-624 002

16.The relative coefficient of performance (C.O.P.)is equal to.....

A.Theoritical C.O.P./Actual C.O.P.

B.Actual C.O.P./Theoritical C.O.P.

C.Theoritical C.O.P. x Actual C.O.P.

D.None of the above

17. The sub-cooling in a refrigeration cycle ....

A.Does not alter C.O.P.

B.Increases C.O.P.

C.Decreases C.O.P.

C.None of the above

18.One tonne of refrigeration is equal to the refrigeration effect corresponding to melting of

1000 kg of ice ....

A.In one hour

B.In one min ute

C.In 24 hours

D.In 12 hours

E.In 10 hours

19.Which of the following cycles uses air as the refrigerant.....

A.Carnot

B.Stirling

C.Ericsson

D.Bell-coleman

E.After passing through the expansion or throttle valve

20.Horse power per ton of refrigeration is expressed as.....

A.4.75/COP

B.COP/4.75

C.4.75 x COP

D.47.5/COP

85/100

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Palani Road, Dindigul 624 002.

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY
Dindigul-Palani Highway, Dindigul – 624 002, Tamilnadu
Tel. No:0451-2448800-899 (100 lines) Fax : 0451-2448855
E mail : ssmictdgl@gmail.com

DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

Time: 30 Minutes

Name of the Student	A. Devarajan
Register Number	922117114021
Year &Section	II CM A

1. One tonne refrigareting machine means.....
A.One tonne is the total mass of the machine
B.One tonne of refrigerant is used
C.One tonne of water can be converted into ice
D.One tonne of ice when melts from at 0°C in 24 hours,the refrigeration effect produced is equivalent to 210 kJ/min

2. During a refrigeration cycle,heat is rejected by the refrigerant in a.....
D.Condenser
A.Compressure
C.Evaporator
D.Expansion valve

3. One tonne of refrigeration is equal to
A.21/kJ/min
B.210/kJ/min
C.420/kJ/min
C.620/kJ/min

4. Air refrigerator works on.....
A. Carnot cycle
B.Rankine cycle
C.Reversed carnot cycle
D.Both C and D

5. The conditioned air supplied to the room must have the capacity to take up.....
A.Room sensible heat load only
B.Room latent heat load only
C.No heat generation
D.Both B and C

6. Air refrigeration cycle is used in.....
A.Commereial refrigerators
B.Domestic refrigerators

Dr.D.SENTHIL KUMAR, M.E., Ph.D., (NUS)
Professor
SSM Institute of Engineering and Technology
Kuttathupatti Village, Nagalagundu (Po),
Palani Road, Dindigul - 624 002.

C.Air-conditioning
D.Gas liquefaction

7. The refrigeran,commonly used in vapour absorption refrigeration systems,is.....

A.Sulphur dioxide
B.Ammonia
C.Freon
D.Aqua-ammonia

8. The boiling point of ammonia is

A.-10.5^{0}C
B.-30.5^{0}C
C.-33.3^{0}C
C.-77.6^{0}C

9. Which of the following refrigerant has the lowest boiling point?.....

A.Ammonia
B.Carbon dioxide
C.Sulphur dioxide
D.Freon-12

10. Which of the following refrigerant is highly toxic and flammable.....

A.Ammonia
B.Carbon dioxide
C.Sulphur dioxide
D.Freon-12

11. The co-efficient of performence is always.....one

A.Equal to
B.less than
C.Greater than
D.None of the above

12. In ammonia-hydrogen refrigerator,.....

A.Ammonia is absorbed in hydrogen
B.Ammonia is absorbed in water
C.Ammonia is evaporets in hydrogen
D.Ammonia is evaporets in ammonia

13. For summer air conditioning, the relative humidity should not be less than....

A.40%
B.60%
C.75%
C.90%

14. For winter air conditioning,the relative humidity should not be more than.....

A.40%
B.60%
C.75%
C.90%

15.In vapour compression refrigeration cycle, the condition of refrigerant is saturated liquid.....

A.Before entering the expansion valve
B.Before entering the compressor
C.After passing through the condenser
D.Before passing through the condenser

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Principal
SSM Institute of Engineering and Technology
Kattathupatti Village, Nagalnagar (Po),
Palani Road, Dindigul 624 002.

16.The relative coefficient of performance (C.O.P.)is equal to.....

A.Theoritical C.O.P./Actual C.O.P.
B.Actual C.O.P./Theoritical C.O.P.
C.Theoritical C.O.P. x Actual C.O.P.
D.None of the above

17. The sub-cooling in a refrigeration cycle ....

A.Does not alter C.O.P.
B.Increases C.O.P.
C.Decreases C.O.P.
C.None of the above

18.One tonne of refrigeration is equal to the refrigeration effect corresponding to melting of
1000 kg of ice ....

A.In one hour
B.In one min ute
C.In 24 hours
D.In 12 hours
E.In 10 hours

19.Which of the following cycles uses air as the refrigerant.....

A.Carnot
B.Stirling
C.Ericsson
D.Bell-coleman
E.After passing through the expansion or throttle valve

20.Horse power per ton of refrigeration is expressed as.....

A.4.75/COP
B.COP/4.75
C.4.75 x COP
D.47.5/COP

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

Time: 30 Minutes

Name of the Student	AFZALIBRAHIM . M
Register Number	92212171140022
Year &Section	II & A

1. One tonne refrigareting machine means.....
A.One tonne is the total mass of the machine
B.One tonne of refrigerant is used
C.One tonne of water can be converted into ice
D.One tonne of ice when melts from at 0^0C in 24 hours,the refrigeration effect produced is equivalent to 210 kJ/min

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C.Air-conditioning
D.Gas liquefaction

7. The refrigeran,commonly used in vapour absorption refrigeration systems,is.......

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Principal
SSM Institute of Engineering and Technology

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B.COP/4.75

C.4.75 x COP

D.47.5/COP

90/100

S. Srinivasan

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Palani Road, Dindigul - 624 002

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Dindigul- Palani Highway, Dindigul – 624 002.

Department of Mechanical Engineering

Value Added Course (2018-2019) Odd Semester

Course Name : Hands on training on Hands on Training in Refrigeration and Air Conditioning
Course Coordinators: Mr. S. Srinivasan & Ms. D. Anitha

MARKS STATEMENT FOR VALUE ADDED COURSE

S.No	Reg.No	Name of the Student	Marks Scored
1	922117114002	AFZALIBRAHIM M	90
2	922117114006	ARULSELVAN K	85
3	922117114007	ARUN KUMAR E	85
4	922117114008	ARUN KUMAR M	85
5	922117114012	ASHLEY SACHIN	75
6	922117114014	BHARATHI DASAN A	85
7	922117114019	DEEPAKRAJ T	85
8	922117114021	DEVARAJAN A	90
9	922117114024	DINESHKUMAR M	75
10	922117114025	DIVYA DHARSHINI K	85
11	922117114026	ESAKKI DURAI PANDI M	90
12	922117114027	ETHIRAJ YOGESH P	75
13	922117114030	GRACE A	85
14	922117114031	GUNAKARAN C	85
15	922117114032	GUNA SEKAR S	85
16	922117114034	HARI HARAN S K (04-10-1999)	90
17	922117114035	HARIHARAN N (26-11-1999)	75
18	922117114037	HARI KRISHNAN S (27-09-1999)	85
19	922117114038	HARI VIGNESH.N	85
20	922117114061	ARUNKUMAR.M	90

Faculty Incharge

HoD/Mech.Engg

Principal

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

Time: 30 Minutes

Name of the Student	GUNA SEKAR . S
Register Number	922117114632
Year &Section	II A

1. One tonne refrigareting machine means.....

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D.Gas liquefaction

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SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul-Palani Highway, Dindigul-624 002.

Department of Mechanical Engineering

Certificate of Completion

This is to certify that Mr. *GUNA SEKAR S* (922117114032)of has successfully completed the value added course on ***"Refrigeration and Air Conditioning"*** organized by the Department of Mechanical Engineering, SSM Institute of Engineering and Technology, Dindigul from 16.07.2018 to 03.08.2018.

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Co-ordinator

Head/Mech.Engg

Principal, SSMIET

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul-Palani Highway, Dindigul-624 002.

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Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (IIT(M))
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Kuttathupatti Village, Sinnalapuram (Po),
Palani Road, Dindigul - 624 002.

Co-ordinator

Head/Mech.Engg

Principal, SSMIET

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul-Palani Highway, Dindigul-624 002.

Department of Mechanical Engineering

Certificate of Completion

This is to certify that Mr. ***DEVARAJAN A***(922117114021)of has successfully completed the value added course on ***"Refrigeration and Air Conditioning"*** organized by the Department of Mechanical Engineering, SSM Institute of Engineering and Technology, Dindigul from 16.07.2018 to 03.08.2018.

Co-ordinator

Head/Mech.Engg

Principal, SSMIET

Dr.D.SENTHIL KUMARAN ME PhD., MISTE
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Palani Road, Dindigul - 624 002.

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul-Palani Highway, Dindigul-624 002.

Department of Mechanical Engineering

Certificate of Completion

This is to certify that Mr. **AFZALIBRAHIM M** (922117114002) of has successfully completed the value added course on *"Refrigeration and Air Conditioning"* organized by the Department of Mechanical Engineering, SSM Institute of Engineering and Technology, Dindigul from 16.07.2018 to 03.08.2018.

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Palani Road, Dindigul - 624 002.

Co-ordinator

Head/Mech.Engg

Principal, SSMIET

"Hands on Training in Refrigeration and Airconditioning"

Value Added Course

Academic Year (2018-2019) Odd Semester

Total hours: 30 Hours

16.07.2018- 03.08.2018

Department of Mechanical Engineering

SSM INSTITUTE OF ENGINEERING & TECHNOLOGY

SSM Institute of Engineering and Technology * DINDIGUL-624 002 *

Course Coordinators :

1. Mr. S. Srinivasan,
2. Ms. D. Anitha.

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DEPARTMENT OF MECHANICAL ENGINEERING

CIRCULAR

10.07.2018

We have planned to conduct the **Refrigeration and Air Conditioning (R&AC)** training program for II Year Mechanical Engineering students from 16.07.2018 onwards. The course will be handled by Mr.S.Srinivasan, AP/Mech, and Ms.D.Anitha, AP/Mech. The interested students are asked to register their names with Ms.D.Anitha, AP/Mech on or before 14.07.2018.

Details about the program

No. of Students to be admitted	: 30
Selection Process	: First come first basis
Duration of the program	: 15 days / 30 hours.
Timing	: 4.30 pm to 6.30 pm

Attendance for the above program is compulsory.

10.7.18
10/7/18

COORDINATORS

[D. ANITHA]

[S. SRINIVASAN]

10/7/18

HOD/MECH

PRINCIPAL

Dr.E.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
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Dindigul- Palani Highway, Dindigul – 624 002.

Department of Mechanical Engineering

06.07.2018

Submitted To Principal

Respected sir,

Sub: Proposal for conducting value added course **(Refrigeration and air conditioning)** – Reg.

We have planned to conduct the training program on "**Refrigeration and air conditioning**" for II year Mechanical Engineering students. We assure that this will be very useful for the students to enhance their knowledge in the field of Thermal Engineering.

Your approval is requested to conduct this program.

Thanking you

Course coordinators
D.ANITHA, AP/Mech,
S.SRINIVASAN ,AP/Mech,

HoD/MECH

PRINCIPAL

Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology

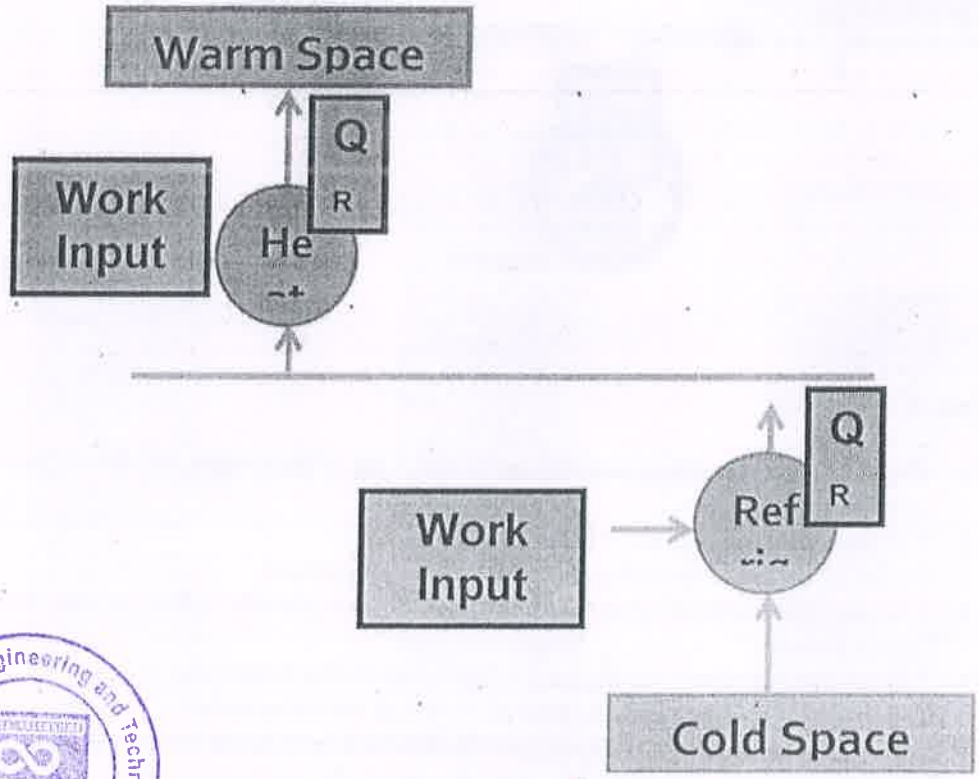
Unit V

Refrigeration and Air-conditioning

Refrigeration : It is defined as the process of providing and maintaining a temperature well below that of surrounding atmosphere. In other words refrigeration is the process of cooling substance.

Refrigerator and Heat Pump:

If the main purpose of the machine is to cool some object, the machine is named as refrigerator.
If the main purpose of machine is to heat a medium warmer than the surroundings, the machine is termed as heat pump



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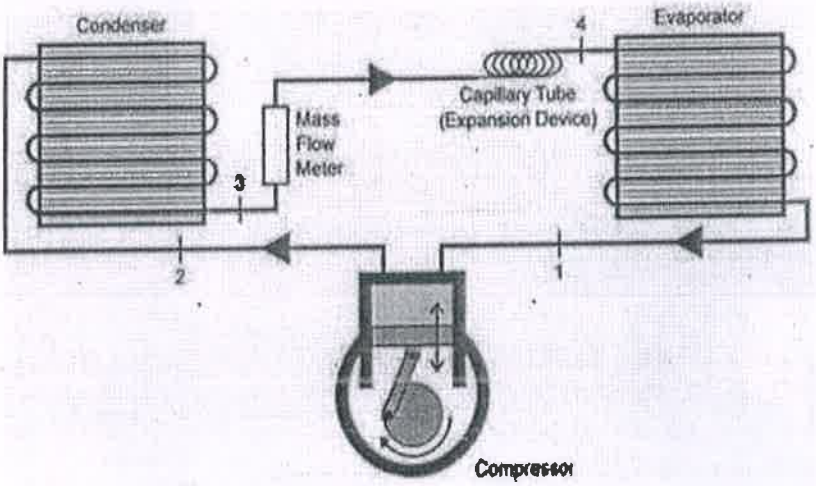
Principal
SSM Institute of Engineering and Technology
Enlathupatty Village, Dindigul (Po),
Palani Road, Dindigul - 624 002.

Applications of Refrigeration :

- In chemical industries, for separating and liquefying the gases.
- In manufacturing and storing ice.
- For the preservation of perishable food items in cold storages.
- For cooling water.
- For controlling humidity of air manufacture and heat treatment of steels.
- For chilling the oil to remove wax in oil refineries.
- For the preservation of tablets and medicines in pharmaceutical industries.
- For the preservation of blood tissues etc.,
- For comfort air conditioning the hospitals, theatres, etc.,

Vapour Compression Refrigeration system :



Working :

1. The low pressure refrigerant vapour coming out of the evaporator flows into the compressor.
2. The compressor is driven by a prime mover.
3. In the compressor the refrigerant vapour is compressed.
4. The high pressure refrigerant vapour from the compressor is then passed through the condenser.
5. The refrigerant gives out the heat it had taken in the evaporator (N)
6. The heat equivalent of work done on it (w) on the compressor.
7. This heat is carried by condenser medium which may be air or water.
8. The high pressure liquid refrigerant then enters the expansion valve.
9. This valve allows the high pressure liquid refrigerant to flow at a controlled rate into the evaporator.
10. While passing though this valve the liquid partially evaporates.

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solution returning from the generator to the absorber.

6. In the generator the warm solution is further heated by steam coils, gas or electricity and the ammonia vapour is driven out of solution.
7. The boiling point of ammonia is less than that of water.
8. Hence the vapours leaving the generator are mainly of ammonia.
9. The weak ammonia solution is left in the generator is called weak aqua.
10. This weak solution is returned to the absorber through the heat exchanger.
11. Ammonia vapours leaving the generator may contain some water vapour.
12. If this water vapour is allowed to the condenser and expansion valve, it may freeze resulting in chocked flow.
13. Analyser and rectifiers are incorporated in the system before condenser.
14. The ammonia vapour from the generator passes through a series of trays in the analyser and ammonia is separated from water vapour.
15. The separated water vapour returned to generator.
16. Then the ammonia vapour passes through a rectifier.
17. The rectifier resembles a condenser and water vapour still present in ammonia vapour condenses and the condensate is returned to analyser.
18. The virtually pure ammonia vapour then passes through the condenser.
19. The latent heat of ammonia vapour is rejected to the cooling water circulated through the condenser and the ammonia vapour is condensed to liquid ammonia.
20. The high pressure liquid ammonia is throttled by an expansion valve or throttle valve.
21. This reduces the high temperature of the liquid ammonia to a low value and liquid ammonia partly evaporates.
22. Then this is led to the evaporator.
23. In the evaporator the liquid fully vaporizes
24. The latent heat of evaporation is obtained from the brine or other body which is being cooled.
25. The low pressure ammonia vapour leaving the evaporator again enters the absorber and the cycle is completed.
26. This cycle is repeated again to provide the refrigerating effect.

Application of Refrigeration system :

- Preservation of food items like vegetables, milk and eggs.
- Preservation of medicines.
- Preservation of blood, tissues, etc.,
- Preservation and cooling of cool drinks.
- Preservation of chemicals (Chemical industries)
- Cooling of water.
- Industrial and comfort airconditioning.
- Processing of dairy products.

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AIRCONDITIONING

Air-conditioning : Air Conditioning is the process of conditioning the air according to the human comfort, irrespective of external conditions.

Applications of Air Conditioning

- Used in offices, hotels, buses, cars.,etc
- Used in industries having tool room machines.
- Used in textile industries to control moisture.
- Used in printing press.
- Used in Food industries, Chemical plants.

Air conditioning systems are classified as

1) According to the purpose

a) Comfort Air conditioning.
b) Industrial Air conditioning.

2) According to Season of the year

a) Summer Air conditioning.
b) Winter Air conditioning.
c) Year round Air conditioning

Types of Air conditioners

a) Room Air conditioners
b) Winter Air conditioners
c) Central Air conditioners

Functions of Air conditioners

a) Cleaning air.
b) Controlling the temp of air.
c) Controlling the moisture content.
d) Circulating the air.

Important Definitions :

1) Dry air: The atmospheric air which no water vapour is called dry air.

2) Psychrometry: Psychrometry is the study of the properties of atmospheric air.

3) Temperature: The degree of hotness (or) Coldness is called the temperature.

4) Moisture: Moisture is the water vapour present in the air

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Working :

- The low pressure vapour refigerant from the evaporator is sucked by compressor through the open inlet valve.
- The compressor compresses the vapour refrigerant.
- The high pressure and high temperature vapour refrigerant then flows to the condenser through the open outlet valve.
- In the condenser, the outside atmospheric temperature in summer being around 42o C, air is circulated by fan.
- After condensation, the high pressure liquid refrigerant formed passes through an expansion valve which reduces its pressure
- The low pressure refrigerant then enters the evaporator and evaporates, thus absorbing latent heat of vapourisation from the room air.
- The equipment which is used for evaporating the refrigerant is called evaporator.
- After evaporation, the refrigerant becomes vapour.
- The low pressure vapour is again passed to the compressor. Thus the cycle is repeated.
- A partition separates high temperature side of condenser, compressor and low temperature side of evaporator
- The quantity of air circulated can be controlled by the dampers.
- 10. The moisture in the air passing over the evaporator coil is dehumidified and drips into the trays.
- The unit automatically stops when the required temperature is reached in the room. This is accomplished by the thermostat and control panel.
- Generally, the refrigerant monochloro diluloro mehane (CHCLF2) is used in air conditioner. It is called Freon 22.

Merits and Demerits of Window type air conditioner

Merits :

- A separate temperature control is provided in each room.
- Ducts are not required for distribution.
- Cost is less.
- Skilled technician is required for installation.

Demerits:

- It makes noise.
- Large hole is made in the external wall or a large opening to be created in the window panel. This leads to insecurity to inmates.
- Air quantity cannot be varied.

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- The hot refrigerant vapour is passed to the compressor and then to the condenser where it becomes liquid.
- Thus the cycle is repeated.
- A thermostat is used to keep the room at a constant, comfortable temperature avoiding the frequent turning on off.

Merits and Demerits of Split type air conditioner :

Merits :

- It is compact
- Upto four indoor AHU's may be connected to one outdoor unit.
- It is energy and money saving.
- Duct is not used.
- Easier to install.
- It is noiseless, because rotary air compressor used is, kept outside.
- It is more efficient and powerful.
- It has the flexibility for zoning.

Demerits :

- Initial cost is higher than window air conditioner
- Skilled technician is required for installation.
- Each zone or room requires thermostat to control the air cooling

Applications of airconditioning :

- Used in houses, hospitals, offices, computer centres, theatres, departmental stores etc.,
- Air-conditioning of transport media such as buses, cars trains, aeroplanes and ships.
- Wide application in food processing, printing, chemical, pharmaceutical and machine tool, etc.,

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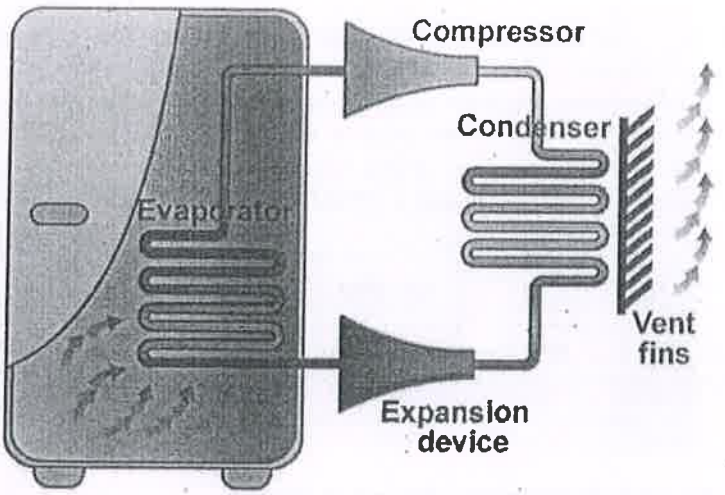

Ref: GKV/5.12-3

An NH_3 refrigerator produces 30tons of ice from and at 0°C in a day of 24hours. The temperature range in the compressor is from 25°C to –15°C. The vapour is dry saturated at the end of compression. Assume a COP 60% theoretical. Calculate the power required to drive the compressor. Assume latent heat of ice is 335kJ/kg. For properties of NH_3 refer table or charts. *[MU - Oct. '98]*

Temperature °C	h_f (kJ/kg)	h_g (kJ/kg)	s_f (kJ/kgK)	s_g (kJ/kgK)
25	298.9	1465.8	1.124	5.039
-15	112.34	1426.5	0.4572	5.549

Ans: Power = 12.4kW

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Ref: GKV/5.15-4

A refrigerating plant using R134a as refrigerant works between 25°C and –5°C. The dryness fraction of R134a is 0.85 at the entry of compressor. 8kg/min of R134a is circulated through the system. Ice is formed at 0°C from the water at 15°C. Calculate the actual COP and the ice formed per day if the relative efficiency is 45%. C_p(water) = 4.187kJ/kgK, h_{fg}(water) = 335kJ/kg. For properties refer the table as given below:

Temperature °C	h_f(kJ/kg)	h_g(kJ/kg)	s_f(kJ/kgK)	s_{fg}(kJ/kgK)
25	133.89	175.14	1.1176	0.5875
5	93.46	198.31	0.976	0.7395

Ans: Ice formed per day = 1.7 tonnes

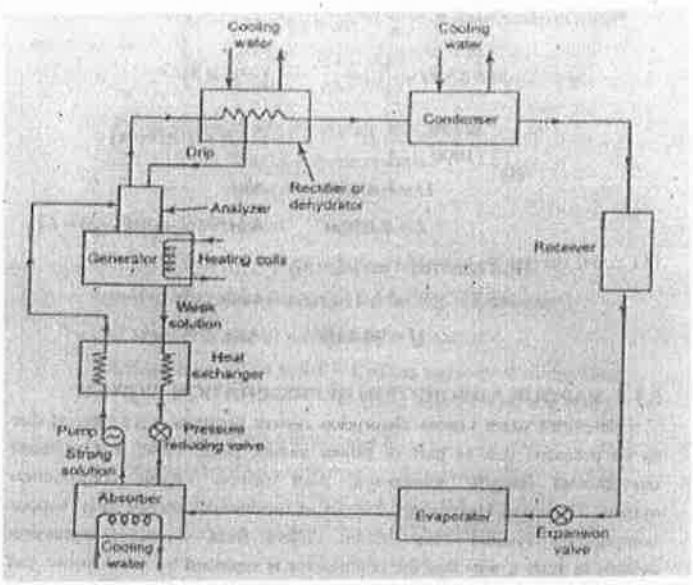
Ref: GKV/5.28-9

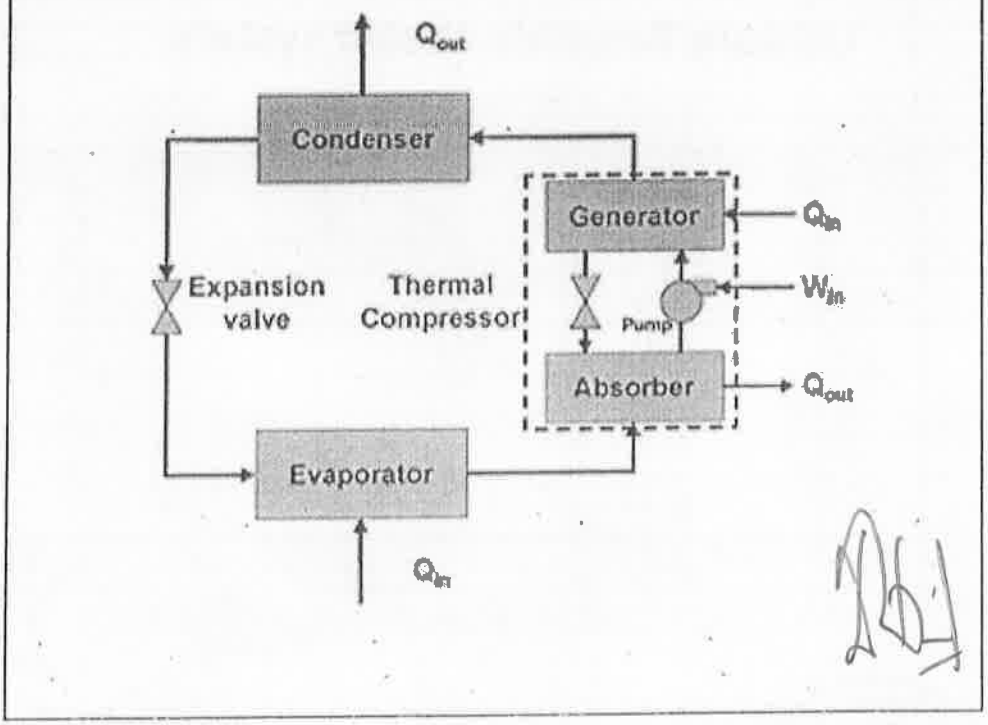
A vapour compression refrigeration plant works between pressure limits of 5.3bar and 2.1bar. The vapour is super heated at the end of compression, its temperature being 37°C. The vapour is super heated by 5°C before entering the compressor. If the specific heat of super heated vapour is 0.63kJ/kgK. Find the co- efficient of performance of the plant. Use the data given below. [MU Apr.'96]

Pressure (bar)	Saturation Temperature °C	Liquid Heat kJ/kg	Latent Heat kJ/kg
5.3	15.5	56.15	144.9
2.1	-14.0	25.12	158.7

Ans: COP= 4.73

Vapour Absorption Refrigeration system (VAR)

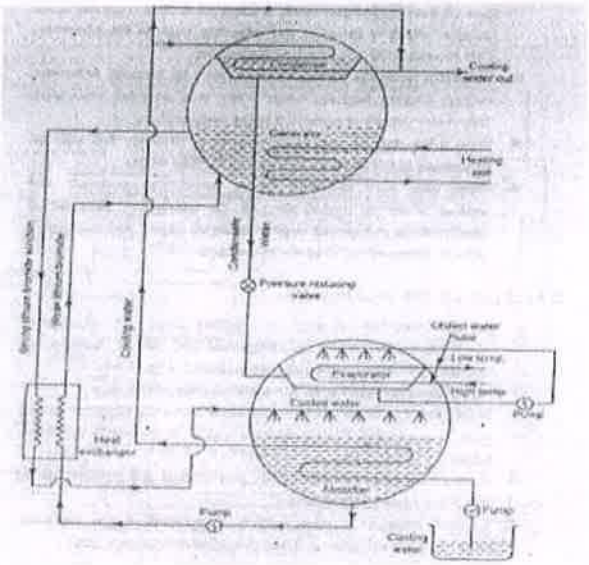




VCR Vs VAR

Sl. No.	Vapour compression system	Vapour absorption System
1.	Electric Power is needed to drive the system.	No need of electric power.
2.	Wear and tear is more because of moving components.	Wear and Tear is less.
3.	Tonne capacity is low.	Tonne capacity is high.
4.	Charging of refrigerant is simple	Charging of refrigerant is difficult.
5.	More chances for leakage of refrigerant.	There is no leakage of refrigerant.
6.	Mechanical energy is supplied	Heat energy is supplied
7.	Performance at part load is poor.	At part loads, the performance is not affected.
8.	Space requirement is more.	Space requirement is less.
9.	Energy requirement is low.	Energy requirement is high.

Lithium Bromide-Water system



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References

1. http://energy.sdsu.edu/testhome/vtAnimations/animations/chapter10/A-vaporCompress/vaporCompCycle.html

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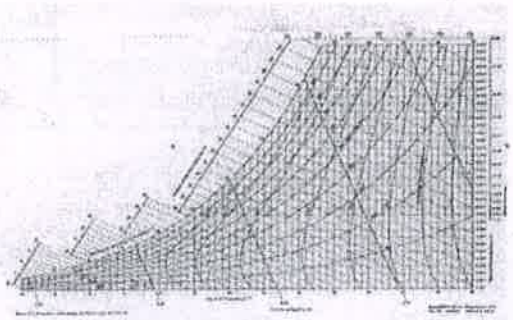
Atmospheric air

- Atmospheric air is not completely dry but a mixture of dry air and water vapor.
- In atmospheric air, the content water vapor varies from 0 to 3% by mass.
- The processes of air-conditioning and food refrigeration often involve removing water from the air (dehumidifying), and adding water to the air (humidifying).

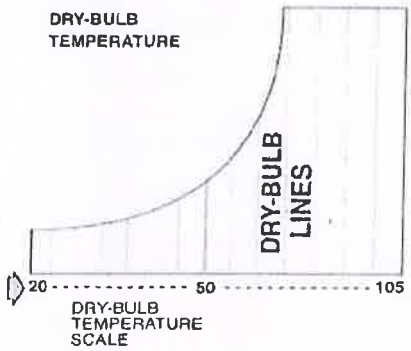
- **Dry air**
  - Air without moisture or water vapour
- **Moist air**
  - Mixture of dry air and water vapour
- **Saturation capacity of air**
  - The maximum quantity of water vapour present in the air at particular air temperature

Psychrometric chart



Dry bulb temperature (t_d)

- Dry bulb temperature is the temperature of the air, as measured by an ordinary thermometer.
- The temperature of water vapor is the same as that of the dry air in moist air.
- Such a thermometer is called a dry-bulb thermometer in psychrometry, because its bulb is dry.



Wet bulb temperature (WBT - t_w)

- It is the temperature of air measured by a thermometer when its bulb is covered with the wet cloth and is exposes to a current rapidly moving air.

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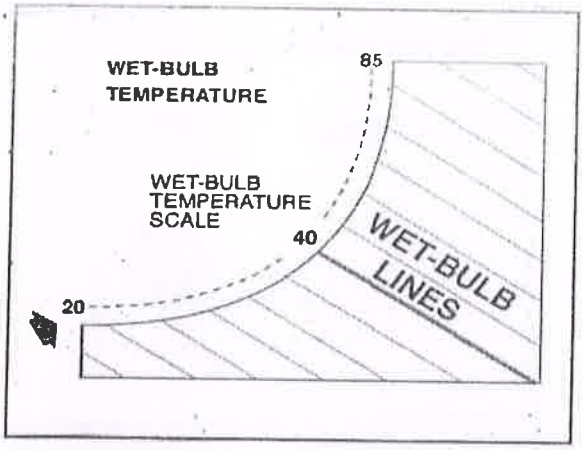
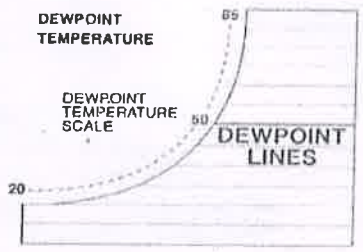


- **Wet bulb depression (WBD)**
  - WBT = DBT – WBT
- **Due point temperature (DPT - t_{dp})**
  - the temperature at which the water present in air begins to condense when air is cooled.
  - For saturated air, DBT, WBT & DPT are all same
- **Due point depression (DPD)**
  - DPD = DBT – DPT

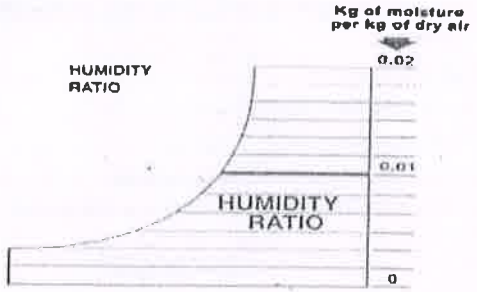
- **Specific humidity / humidity ratio / moisture content**
  - Mass of water vapour present in one kg of dry air.
  - Ratio of mass of water vapour to the mass of dry air in a given volume of moisture.
  - $\acute{\omega} = \frac{0.622 P_v}{P_b - P_v}$
  - P_v, P_a = Partial pressure of water vapour and dry air
  - $p_a V = m_a R_a T$ / $p_v V = m_v R_v T$
  - P_b – barometric pressure

- **Degree of saturation / percentage saturation / saturation ratio (μ)**
  - The ratio of specific humidity of the moist air to the specific humidity of saturated air at the same temperature.
  - $\mu = \acute{\omega} / \acute{\omega}$
  - $\mu = \frac{P_v}{P_s}\left[\frac{P_b - P_s}{P_b - P_v}\right]$

Due point temperature (DPT - t_{dp})



Specific humidity / humidity ratio / moisture content



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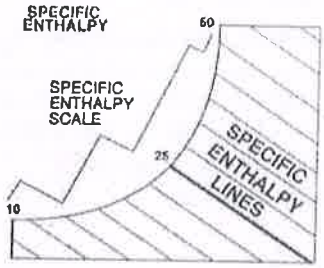
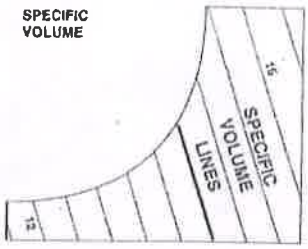
Specific enthalpy lines



Specific volume lines



Relative humidity

- Ratio between actual mass of water vapour in a given volume to the saturated mass of water in same volume and temperature.

$$\Phi = \frac{mass\ of\ water\ vapor\ in\ given\ volume}{saturated\ mass\ of\ water\ vapour\ in\ same\ volume\ of\ temperature}$$

Total enthalpy

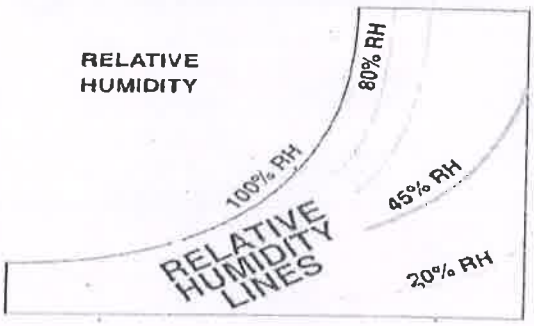
- Total enthalpy of moist air is the sum of the enthalpy of dry air and the enthalpy of water vapour associated with the dry air.
- $H = C_p t_d + \acute{\omega} h_g$
  - C_p = Specific heat at constant pressure = 1.005 kJ/kgK
  - t_d = dry bulb temperature
  - $\acute{\omega}$ = specific humidity
  - h_g = specific enthalpy of air corresponding to DBT.

Dalton's law of partial pressure

- The total pressure exerted by air and water vapour mixture is equal to the barometric pressure
- $P_b = P_a + P_v$
  - P_b = barometric pressure
  - P_a = partial pressure of dry air
  - P_v = partial pressure of water vapour
  - P_{sw} = Saturation pressure corresponding to WBT

$$P_v = P_{sw} = \frac{(P_b - P_{sw})(t_d - t_w)}{1527.4 - 1.3 t_w}$$

Relative humidity lines



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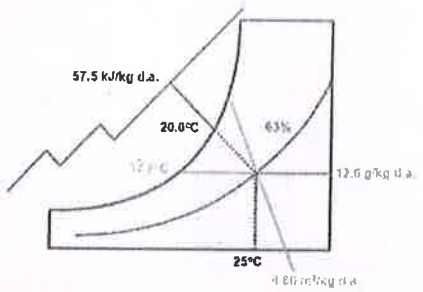
Psychrometric chart ...



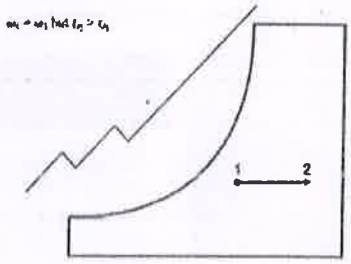
Air conditioning process

1. Sensible heating process
2. Sensible cooling process
3. Humidification process
4. Dehumidification process
5. Heating and humidification process
6. Cooling and dehumidification process
7. Adiabatic mixing air streams process
8. Evaporative cooling process.

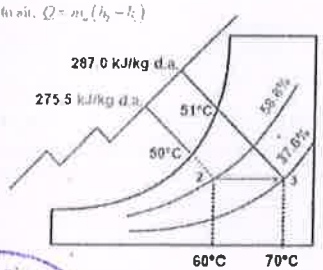
Bypass factor

- The efficiency of heating coil is measured in terms of by pass factor.
- By pass factor is defined as the portion of the air that passes through the coil without contacting the coil surface.
- It is denoted by BPF.

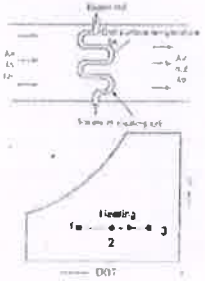
Sensible heating



Sensible heating ...



Sensible heating ...



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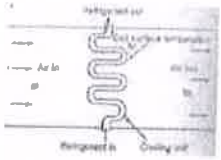
Sensible cooling



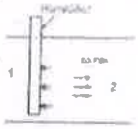
$t_{d_1} > t_{d_2}$ and $\omega_1 = \omega_2$

$$BPF = \frac{t_{d_2} - t_{d_3}}{t_{d_1} - t_{d_3}}$$

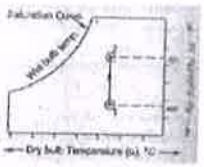
$t_{d_1} < t_{d_2} < t_{d_3}$

$Q = m_a(h_1 - h_2)$

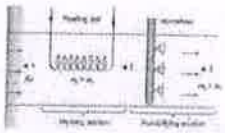
Humidification process



$Q = m_a(h_2 - h_1)$



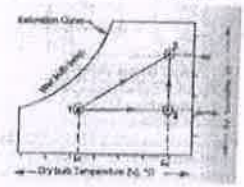
Heating and humidifying



$TH\Sigma$ = Sensible heat load, $SH\Sigma$ + Latent heat load, $LH\Sigma$

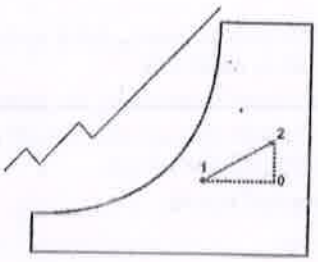
$SH\Sigma = (h_2 - h_1) = (h_3 - h_4)$

The ratio of sensible heat load to the total heat load is known as sensible heat factor or sentable heat ratio (SHF).

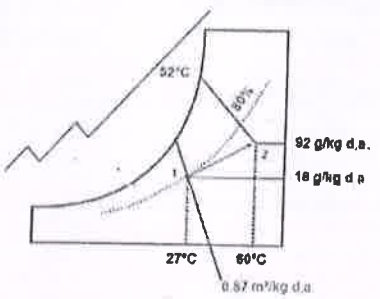


$$SHF = \frac{SH\Sigma}{SH\Sigma + LH\Sigma} = \frac{h_2 - h_1}{(h_2 - h_1) + (h_3 - h_4)}$$

Heating and humidifying ...



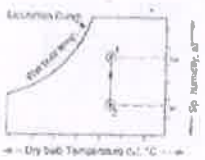
Heating and humidifying ...



Dehumidification process

Latent heat load, $Q = m_a(h_1 - h_2)$

$\omega_1 > \omega_2$, $\phi_1 > \phi_2$ but $t_{d_1} = t_{d_2}$



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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 30/10/18

NAME OF THE STUDENT	K. ARUL SELVAM
YEAR	II Year
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor

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(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 03.08.18

NAME OF THE STUDENT	ARUN kumar. M
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
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5. Explanation and Clarity (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor

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Dindigul-Palani Highway, Dindigul – 624 002, Tamilnadu

Tel. No:0451-2448800-899 (100 lines) Fax : 0451-2448855

E-mail : ssmietdgl@gmail.com

DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON R&AC

(16.07.18)

FEED BACK FORM

DATE: _____

NAME OF THE STUDENT	K. Divya dharshini.
YEAR	II nd year.
CONTACT NO./ EMAIL	8838701002 / divyadharshinik28102@gmail.com

1. Course objective and scope in the industry (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 03.08.18

NAME OF THE STUDENT	Hari krishnan . S
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✓ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✓ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor
4. Usefulness (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✓ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor

Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti (Po),
Palani. 624 002.

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6. Exercises given (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
7. Time for Interaction (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
8. Simplification of the concepts and practice (Please put ✔ mark)	☐ Excellent ☐ Good ☑ Average ☐ Poor
9. Overall performance of the trainer as a leader (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
10. Rank the Workshop (Please put ✔ mark)	☑ (5) Excellent ☐ (3) Good ☐ (2) Average ☐ (0) Poor
Comments / Suggestions (if any)	

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Dr.D.SENTHIL KUMAR M.E., Ph.D.,
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village Sindalagundu Pol,
Palani Road, Dindigul 624 002.

Signature of the Student

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON R&AC

(16.07.18)

FEED BACK FORM

DATE: 25.10.2018.

NAME OF THE STUDENT	A. GRACE
YEAR	II Year
CONTACT NO./ EMAIL	9600310081 / graceaaruljeyaraj@gmail.com

1. Course objective and scope in the industry (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✓ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✓ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✓ mark)	☐ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✓ mark)	☐ Excellent ☐ Good ☐ Average ☐ Poor

Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 3.8.18

NAME OF THE STUDENT	Essaki Durai Pandi . M
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor

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Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (USA)
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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

FEED BACK FORM

DATE: 3-8-18

NAME OF THE STUDENT	N. Hari Vignesh
YEAR	II
CONTACT NO./ EMAIL	/

1. Course objective and scope in the industry (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor.
2. Knowledge and exposure of the trainer in the domain (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
3. Content coverage (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
4. Usefulness (Please put ✔ mark)	☑ Excellent ☐ Good ☐ Average ☐ Poor
5. Explanation and Clarity (Please put ✔ mark)	☐ Excellent ☑ Good ☐ Average ☐ Poor

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S.S.M. Engineering and Technology
DINDIGUL-624 002

16.The relative coefficient of performance (C.O.P.)is equal to.....

A.Theoritical C.O.P./Actual C.O.P.

B.Actual C.O.P./Theoritical C.O.P.

C.Theoritical C.O.P. x Actual C.O.P.

D.None of the above

17. The sub-cooling in a refrigeration cycle ....

A.Does not alter C.O.P.

B.Increases C.O.P.

C.Decreases C.O.P.

C.None of the above

18.One tonne of refrigeration is equal to the refrigeration effect corresponding to melting of

1000 kg of ice ....

A.In one hour

B.In one min ute

C.In 24 hours

D.In 12 hours

E.In 10 hours

19.Which of the following cycles uses air as the refrigerant.....

A.Carnot

B.Stirling

C.Ericsson

D.Bell-coleman

E.After passing through the expansion or throttle valve

20.Horse power per ton of refrigeration is expressed as.....

A.4.75/COP

B.COP/4.75

C.4.75 x COP

D.47.5/COP

85/100

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

Time: 30 Minutes

Name of the Student	A. Devarajan
Register Number	922117114021
Year &Section	II CM A

1. One tonne refrigareting machine means.....
A.One tonne is the total mass of the machine
B.One tonne of refrigerant is used
C.One tonne of water can be converted into ice
D.One tonne of ice when melts from at 0°C in 24 hours,the refrigeration effect produced is equivalent to 210 kJ/min

2. During a refrigeration cycle,heat is rejected by the refrigerant in a.....
D.Condenser
A.Compressure
C.Evaporator
D.Expansion valve

3. One tonne of refrigeration is equal to
A.21/kJ/min
B.210/kJ/min
C.420/kJ/min
C.620/kJ/min

4. Air refrigerator works on.....
A. Carnot cycle
B.Rankine cycle
C.Reversed carnot cycle
D.Both C and D

5. The conditioned air supplied to the room must have the capacity to take up.....
A.Room sensible heat load only
B.Room latent heat load only
C.No heat generation
D.Both B and C

6. Air refrigeration cycle is used in.....
A.Commereial refrigerators
B.Domestic refrigerators

Dr.D.SENTHIL KUMAR, M.E., Ph.D., (NUS)
Professor
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Kuttathupatti Village, Nagalagundu (Po),
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C.Air-conditioning
D.Gas liquefaction

7. The refrigeran,commonly used in vapour absorption refrigeration systems,is.....

A.Sulphur dioxide
B.Ammonia
C.Freon
D.Aqua-ammonia

8. The boiling point of ammonia is

A.-10.5^{0}C
B.-30.5^{0}C
C.-33.3^{0}C
C.-77.6^{0}C

9. Which of the following refrigerant has the lowest boiling point?.....

A.Ammonia
B.Carbon dioxide
C.Sulphur dioxide
D.Freon-12

10. Which of the following refrigerant is highly toxic and flammable.....

A.Ammonia
B.Carbon dioxide
C.Sulphur dioxide
D.Freon-12

11. The co-efficient of performence is always.....one

A.Equal to
B.less than
C.Greater than
D.None of the above

12. In ammonia-hydrogen refrigerator,.....

A.Ammonia is absorbed in hydrogen
B.Ammonia is absorbed in water
C.Ammonia is evaporets in hydrogen
D.Ammonia is evaporets in ammonia

13. For summer air conditioning, the relative humidity should not be less than....

A.40%
B.60%
C.75%
C.90%

14. For winter air conditioning,the relative humidity should not be more than.....

A.40%
B.60%
C.75%
C.90%

15.In vapour compression refrigeration cycle, the condition of refrigerant is saturated liquid.....

A.Before entering the expansion valve
B.Before entering the compressor
C.After passing through the condenser
D.Before passing through the condenser

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Dr.D.SRINIVASAN, M.E., Ph.D., [NUS]
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Palani Road, Dindigul 624 002.

16.The relative coefficient of performance (C.O.P.)is equal to.....

A.Theoritical C.O.P./Actual C.O.P.
B.Actual C.O.P./Theoritical C.O.P.
C.Theoritical C.O.P. x Actual C.O.P.
D.None of the above

17. The sub-cooling in a refrigeration cycle ....

A.Does not alter C.O.P.
B.Increases C.O.P.
C.Decreases C.O.P.
C.None of the above

18.One tonne of refrigeration is equal to the refrigeration effect corresponding to melting of
1000 kg of ice ....

A.In one hour
B.In one min ute
C.In 24 hours
D.In 12 hours
E.In 10 hours

19.Which of the following cycles uses air as the refrigerant.....

A.Carnot
B.Stirling
C.Ericsson
D.Bell-coleman
E.After passing through the expansion or throttle valve

20.Horse power per ton of refrigeration is expressed as.....

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B.COP/4.75
C.4.75 x COP
D.47.5/COP

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

Time: 30 Minutes

Name of the Student	AFZALIBRAHIM . M
Register Number	92212171140022
Year &Section	II & A

1. One tonne refrigareting machine means.....
A.One tonne is the total mass of the machine
B.One tonne of refrigerant is used
C.One tonne of water can be converted into ice
D.One tonne of ice when melts from at 0^0C in 24 hours,the refrigeration effect produced is equivalent to 210 kJ/min

2. During a refrigeration cycle,heat is rejected by the refrigerant in a.....
B.Condenser
A.Compressure
C.Evaporator
D.Expansion valve

3. One tonne of refrigeration is equal to
A.21/kJ/min
B.210/kJ/min
C.420/kJ/min
C.620/kJ/min

4. Air refrigerator works on.....
A. Carnot cycle
B.Rankine cycle
C.Reversed carnot cycle
D.Both C and D

5. The conditioned air supplied to the room must have the capacity to take up.....
A.Room sensible heat load only
B.Room latent heat load only
C.No heat generation
D.Both B and C

6. Air refrigeration cycle is used in.....
A.Commercial refrigerators
B.Domestic refrigerators

Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
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Palani Road, Dindigul 624 002.

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C.Air-conditioning
D.Gas liquefaction

7. The refrigeran,commonly used in vapour absorption refrigeration systems,is.......

A.Sulphur dioxide
B.Ammonia
C.Freon
D.Aqua-ammonia

8. The boiling point of ammonia is

A.-10.5^{0}C
B.-30.5^{0}C
C.-33.3^{0}C
C.-77.6^{0}C

9. Which of the following refrigerant has the lowest boiling point?.......

A.Ammonia
B.Carbon dioxide
C.Sulphur dioxide
D.Freon-12

10. Which of the following refrigerant is highly toxic and flammable.......

A.Ammonia
B.Carbon dioxide
C.Sulphur dioxide
D.Freon-12

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A.Equal to
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A.Before entering the expansion valve
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Principal
SSM Institute of Engineering and Technology

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D.None of the above

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B.Stirling

C.Ericsson

D.Bell-coleman

E.After passing through the expansion or throttle valve

20.Horse power per ton of refrigeration is expressed as.....

A.4.75/COP

B.COP/4.75

C.4.75 x COP

D.47.5/COP

90/100

S. Srinivasan

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Dindigul- Palani Highway, Dindigul – 624 002.

Department of Mechanical Engineering

Value Added Course (2018-2019) Odd Semester

Course Name : Hands on training on Hands on Training in Refrigeration and Air Conditioning
Course Coordinators: Mr. S. Srinivasan & Ms. D. Anitha

MARKS STATEMENT FOR VALUE ADDED COURSE

S.No	Reg.No	Name of the Student	Marks Scored
1	922117114002	AFZALIBRAHIM M	90
2	922117114006	ARULSELVAN K	85
3	922117114007	ARUN KUMAR E	85
4	922117114008	ARUN KUMAR M	85
5	922117114012	ASHLEY SACHIN	75
6	922117114014	BHARATHI DASAN A	85
7	922117114019	DEEPAKRAJ T	85
8	922117114021	DEVARAJAN A	90
9	922117114024	DINESHKUMAR M	75
10	922117114025	DIVYA DHARSHINI K	85
11	922117114026	ESAKKI DURAI PANDI M	90
12	922117114027	ETHIRAJ YOGESH P	75
13	922117114030	GRACE A	85
14	922117114031	GUNAKARAN C	85
15	922117114032	GUNA SEKAR S	85
16	922117114034	HARI HARAN S K (04-10-1999)	90
17	922117114035	HARIHARAN N (26-11-1999)	75
18	922117114037	HARI KRISHNAN S (27-09-1999)	85
19	922117114038	HARI VIGNESH.N	85
20	922117114061	ARUNKUMAR.M	90

Faculty Incharge

HoD/Mech.Engg

Principal

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DEPARTMENT OF MECHANICAL ENGINEERING

TECHNICAL COURSE ON REFRIGERATION AND AIR CONDITIONING

(16.07.18 to 03.08.18)

Time: 30 Minutes

Name of the Student	GUNA SEKAR . S
Register Number	922117114632
Year &Section	II A

1. One tonne refrigareting machine means.....

A.One tonne is the total mass of the machine

B.One tonne of refrigerant is used

C.One tonne of water can be converted into ice

D.One tonne of ice when melts from at 0^0C in 24 hours,the refrigeration effect produced is equivalent to 210 kJ/min

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B.Condenser

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6. Air refrigeration cycle is used in.....

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B.Domestic refrigerators

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C.Air-conditioning
D.Gas liquefaction

7. The refrigeran,commonly used in vapour absorption refrigeration systems,is.....

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A.40%
B.60%
C.75%
C.90%

14. For winter air conditioning,the relative humidity should not be more than.....

A.40%
B.60%
C.75%
C.90%

15.In vapour compression refrigeration cycle, the condition of refrigerant is saturated liquid.....

A.Before entering the expansion valve
B.Before entering the compressor
C.After passing through the condenser
D.Before passing through the condenser

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Palani Road, Dindigul 624 002.

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul-Palani Highway, Dindigul-624 002.

Department of Mechanical Engineering

Certificate of Completion

This is to certify that Mr. ***GUNA SEKAR S*** (922117114032)of has successfully completed the value added course on ***"Refrigeration and Air Conditioning"*** organized by the Department of Mechanical Engineering, SSM Institute of Engineering and Technology, Dindigul from 16.07.2018 to 03.08.2018.

Co-ordinator | **Head/Mech.Engg** | **Principal, SSMIET**

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Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (IIT(M))
Principal
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Kuttathupatti Village, Sinnalapuram (Po),
Palani Road, Dindigul - 624 002.

Co-ordinator

Head/Mech.Engg

Principal, SSMIET

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul-Palani Highway, Dindigul-624 002.

Department of Mechanical Engineering

Certificate of Completion

This is to certify that Mr. ***DEVARAJAN A***(922117114021)of has successfully completed the value added course on ***"Refrigeration and Air Conditioning"*** organized by the Department of Mechanical Engineering, SSM Institute of Engineering and Technology, Dindigul from 16.07.2018 to 03.08.2018.

Co-ordinator

Head/Mech.Engg

Principal, SSMIET

Dr.D.SENTHIL KUMARAN ME PhD., MISTE
Principal
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Certificate of Completion

This is to certify that Mr. **AFZALIBRAHIM M** (922117114002) of has successfully completed the value added course on *"Refrigeration and Air Conditioning"* organized by the Department of Mechanical Engineering, SSM Institute of Engineering and Technology, Dindigul from 16.07.2018 to 03.08.2018.

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