5th Sem. /MECH/DIP IN MECH/MECH(PROD)/MECH(MAINT)/
MECH(IND INTG)/MECH(SWITCH)/ 2021(W)

Th5 Refrigeration & Air Conditioning

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. Define tonne of refrigeration.

b. What is the function of refrigerant?

c. Differentiate between open & closed air refrigeration system.

d. Draw schematic diagram of Bell-Coleman cycle.

e. Write the function of rectifier in VARS.

f. Why condenser is used in refrigeration cycle?

g. Write function of expansion valves with two examples.

h. What is the chemical formula of refrigerant dichloro-difluro methane?

i. Define relative humidity.

j. Write conditions of comfort air conditioning.

2. Answer **Any Six** Questions 6 x 5

a. Compare between VCRS and VARS.

b. Explain working of single acting reciprocating air compressor with suitable diagram.

c. What should be the desirable properties of an ideal refrigerant?

d. Describe Winter Air Conditioning system.

e. Explain Shell and tube type evaporator.

f. Write about the factors affecting comfort air conditioning.

g In a refrigeration system working on Joule cycle, air is compressed to 5bar from 7bar.Its initial temperature is 10°C.After compression, air is cooled upto 20°C in a cooler before expanding back to the pressure of 1 bar. Find COP of the system. Take C_P & C_v value for air as 1.005KJ/Kg-K & 0.718 KJ/Kg-K respectively.

5TH SEM/ MECH/ MECH(SAND)/ MECH(PROD) /MECH(MAINT.)/ DIP.MECH/ 2020(W)NEW

Th-5 Refrigeration & Air Conditioning

Full Marks: 80 Time- 3 Hrs

Answer any five Questions including Q No.1& 2
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1. Answer **All** questions 2 x 10

a. What do you mean by refrigeration?

b. Define 'tonne' of refrigeration.

c. Differentiate between primary refrigerant and secondary refrigerant.

d. What are the chemical formulae of refrigerant R-11, R-13, R-21 and R-22?

e. What are the equipments used in an Air-conditioning system?

f. What is the use of Air filter and blower in air conditioning system?

g. Define sensible heat factor.

h. What is Dry-bulb temperature?

i. What are the physical properties of refrigerant?

j. Give the classification of evaporators.

2. Answer **Any Six** Questions 6 x 5

a. Describe chemical properties of refrigerants.

b. With the help of neat diagram explain the working of a thermostatic expansion valve.

c. Enumerate the desirable properties of an ideal refrigerant.

d. With the help of Psychrometric chart, Explain sensible cooling and sensible heating.

e. Draw the P-V and T-S diagram for a reversed Brayton cycle and derive the expression for its COP.

f. What are the applications of refrigeration? Explain ice plant layout.

g In vapour absorption refrigeration system, heating, cooling and refrigeration take place at the temperatures of 100°c, 20°c and -5° respectively. Find the maximum C.O.P of the system.

3	With neat sketch, describe practical vapour absorption refrigeration system.	10
4	Explain in details about the summer air conditioning and winter air-conditioning system.	10
5	Explain with the help of neat sketch, the principle of operation of a single stage, single acting reciprocating compressor.	10
6	In an ammonia vapour compression system, the pressure in the evaporator is 2bar. Ammonia at exit is 0.85 dry and at entry its dryness fraction is 0.19. During compression the work done per kg of ammonia is 150kJ. Calculate the C.O.P. and the volume of vapour entering the compressor per minute. If the rate of ammonia circulation is 4.5kg/min. The latent heat and specific volume at 2bar are 1325kJ/kg and 0.58m^3/kg respectively.	10
7	In an absorption type refrigerator, the heat is supplied to NH_3 generator by condensing steam at 2bar and 90% dry. The temperature in the refrigerator is to be maintained at -5°C.Find the maximum C.O.P. possible. If the refrigeration load is 20 tonnes and actual C.O.P. is 70% of the maximum C.O.P., Find the mass of steam required per hour. Take temperature of the atmosphere as 30°C.	10

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3 Explain simple Vapour Absorption Refrigeration System with neat sketch. 10

4 A VCRS uses refrigerant R-40 and operates between temperature limits of -10°C & 45°C.At entry to the compressor, refrigerant is dry saturated & after compression it acquires a temperature of 60°C. Find COP of the refrigerating system. The properties of R-40 are 10

Temp in °C	h_f(KJ/Kg)	h_g(KJ/Kg)	S_f(KJ/Kg-k)	S_g(KJ/Kg-k)
-10	45.4	460.7	0.183	1.637
45	133	483.6	0.485	1.587

5 The atmospheric air at 25°C DBT and 12°C WBT is flowing at the rate of 100m^3/min through the duct. The dry saturated steam at 100°C is injected into the air stream at the rate of 72 Kg/Hour. Calculate specific humidity and enthalpy of the leaving air. Also determine DBT,WBT & relative humidity of leaving air. 10

6 Write short notes on 10

a) Automatic Expansion Valve

b)Cold storage plant

7 What is psychometric chart? write its uses. Explain different types of psychometric processes. 10

5TH SEM /MECHANICAL/ MECH(MAIN)/ MECH(PROD)/ MECH(SAND) / DIP IN MECH/ MECH(INDUSTRY INTEGRATION)/ 2022(W)

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Time- 3 Hrs

Full Marks: 80

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks
PSYCHOMETRICS CHARTS ALLOWED

2 x 10

1. Answer **All questions**
   a. What is sensible heat factor?
   b. Discuss about closed system Brayton Cycle.
   c. State the unit of refrigerating effect.
   d. What is saturated air?
   e. How does an air filter work?
   f. Define refrigeration.
   g. What is moist air?
   h. What is humidity ratio?
   i. What do you understand by human comfort?
   j. Why a comfort chart is recommended?

6 x 5

2. Answer **Any Six** Questions
   a. What do you mean by wet bulb temperature? Explain how it is different from dew point temperature.
   b. Describe different components of a simple vapour compression refrigeration system.
   c. Classify air-conditioning system.
   d. Discuss in brief about the filters and fans used in air-conditioning system.
   e. Air at 40^0C has a relative humidity of 98%. What is dew point temperature? What mass of liquid water per kg of dry air will result if the moisture is cooled to 8^0C at constant pressure of 85KPa.
   f. State the factors considered while selection of a refrigerant for a system.
   g Differentiate between summer air-conditioning system and winter air-conditioning system

3 Explain briefly with a neat diagram the working of a practical vapour absorption system. 10

4 1kg of air at a pressure of 1.2bar and a temperature of 18^0C is compressed to 5.5bar. It is then cooled to 25^0C in the cooler before entering the expansion cylinder. Assuming compression and expansion as isentropic processes, determine the refrigerating effect per kg of air and theoretical COP. Take C_p = 1.0 & γ=1.4. 10

5 Describe in detail the summer air conditioning system with neat sketch. 10

6 How the load for air-conditioning is calculated? What are the factors which are to be considered while evaluating the heat gains? 10

7 A sling psychrometer recorded WBT and DBT as 22^0C and 28^0C. Calculate the Vapour Pressure, Degree of saturation, Relative humidity and Specific humidity. 10