PAPER ID-420399

Subject Code: KME601

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VI) THEORY EXAMINATION 2021-22
REFRIGERATION AND AIR CONDITIONING

Time: 3 Hours ***Total Marks: 100***

Note: **1.** Attempt all Sections. If require any missing data; then choose suitably. Use of steam tables are permitted.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Qno.	Question	Marks	CO
a.	A machine working on reversed Carnot Cycle operates between 300K and 200 K. Determine the COP when it is operated as 1. A refrigerating machine 2. A heat pump	2	1
b.	List down the advantages of multistage vapor compression over single compression.	2	2
c.	Compare various air cooling systems used for aircraft with the help of DART and Mach Number.	2	3
d.	Calculate the relative humidity and specific humidity of air at 1 atm. pressure. Mass of dry air is 1 kg, mass of water vapor is 0.01 kg and it can hold maximum of 0.02 kg of water vapor.	2	4
e.	What the factors that affect human comfort? Discuss the use of comfort chart.	2	1
f.	What is the name of refrigerant R-12 and R-729? And write the names of future refrigerants.	2	4
g.	Write down the principle of thermo electric refrigeration system.	2	3
h.	Explain how ozone layer depletion occurs? What is the method to prevent the further depletion?	2	1
i.	What is dry ice? And how it is prepared.	2	1
j.	What is regenerative air cooling system? Explain in brief.	2	3

SECTION B

2. Attempt any *three* of the following:

Qno.	Question	Marks	CO
a.	Define a) Dew point temperature b) Adiabatic saturation temperature c) Sensible Heat Factor d) Apparatus Dew point e) Dry Bulb Temperature	10	1
b.	Discuss various factors/components of a cooling load imposed on air conditioning plant.	10	5
c.	Discuss with the help of schematic diagram and T-s diagram the Cascade refrigeration system. Further show that intermediate temperature is geometric mean of upper and lower temperature limits.	10	3
d.	Explain with the figure Lithium Bromide water absorption system	10	3
e.	Discuss Boot- strap air evaporative cooling system with the help schematic and T-s diagram.	10	3

SECTION C

3. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	A single compressor using R-12 as refrigerant has three evaporators of capacities 10 TR, 30 TR and 20 TR. The temperature in all the three evaporators is to be maintained at -5^0C. The vapors leaving the evaporators are dry and saturated. The condenser temperature is 40^0C. The liquid refrigerant leaving the condenser is sub cooled to 30^0C.	10	5

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	Assuming isentropic compression, find the power required to drive the compressor and cop of the system.		
b.	An AC system is take outdoor air at 10^0C and 30% relative humidity at a steady rate of 45 m^3/min and to condition it to 25^0C and 60% relative humidity. The outdoor air is first heated to 22^0C in the heating section and then humidified by the hot steam. Assuming constant pressure as 100 kPa, determine a) the rate of heat supply in the heating section b) the mass flow rate of the steam required in the humidifying section.	10	4

4. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	An air refrigerator working on Bell Coleman cycle takes air into the compressor at 1 bar and 268 K. It is compressed in the compressor to 5 bar and cooled to 298 K at the same pressure. It is further expanded in the expander to 1 bar and discharged to take the cooling load. The isentropic efficiencies of the compressor and expander are 85% and 90% respectively. Determine: 1. Refrigeration capacity of the system if the air circulated is 40 kg/min; 2. Power required for the compressor 3. COP of the system	10	5
b.	Air refrigeration used for food storage provides 25TR. The temperature of air entering the compressor is 7^0C and the temperature at exit of cooler is 27^0C. Find COP of the cycle and power per tone of refrigeration required by the compressor. The quantity air circulated in the system is 3000 kg/h. the compression and expansion both follows the law $pv^{1.3} = C$ and take ratio of specific heat as 1.4 and $C_p = 1$ kJ/kgK	10	5

5. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Explain the effects of sub-coling and superheating of refrigerant vapor on COP of the cycle.	10	6
b.	Discuss in detail water-ammonia absorption system.	10	3

6. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Explain magnetic and steam jet refrigeration system.	10	3
b.	Discuss in detail the application of refrigeration in food storage and cold storage.	10	3

7. Attempt any *one* part of the following:

Qno.	Question	Marks	CO
a.	Explain evaporative cooling and adiabatic mixing of airstreams with the help of schematic psychrometric chart.	10	2
b.	Drive the expression for COP of simple air evaporative cooling system with the help schematic and T-s diagram.	10	3