Total No. of Questions : 4]

SEAT No. :

P5201

[Total No. of Pages : 3

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B.E. (Mechanical Engineering) (Insem)

HEATING VENTILATION AIR-CONDITIONING AND REFRIGERATION

(2019 Pattern) (Semester-VII) (402041)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain physical requirements while selecting a refrigerant. **[5]**

b) A boot-strap cooling system of 10 TR is used in an aeroplane. The ambient air temperature and pressure are 15ºC and 0.85 bar respectively. The pressure of air increases to 1 bar due to isentropic ramming action of air. The pressure of air discharged from the main compressor is 3.5 bar. The discharge pressure of air from the auxiliary compressor is 4.25 bar. The isentropic efficiency of each of the compressors is 90%, while that of the turbine is 85%. The effectiveness of both the heat exchangers is 0.7. If the cabin is to be maintained at 22ºC and the pressure in the cabin is 0.9 bar. **[10]**

Take Cp = 1.005 kJ/kg K, $\gamma = 1.4$. Draw T-s diagram.

Find:

i) Mass of air circulated

ii) Power of the system and

iii) COP of the system

OR

Q2) a) Explain Recovery, Recycling and Reclaiming of refrigerant. **[5]**

b) A simple air refrigeration system is used for an aircraft to take a load of 20 TR. The ambient pressure and temperature are 0.9 bar and 22ºC. The pressure of air is increased to 1 bar due to isentropic ramming action. The air is further compressed in a compressor to 3.5 bar and then cooled in a heat exchanger to 72ºC. Finally, the air is passed through the cooling turbine and then it is supplied to the cabin at 1.03 bar. The air leaves the

P.T.O.

cabin at a temperature of 25ºC. Assuming the isentropic efficiency of compressor and turbine as 80% and 75%. **[10]**

Take Cp=1.005 kJ/kg K, γ =1.4. Draw T-s diagram.

Find:

i) Mass of air circulated

ii) Power of the system and

iii) COP of the system.

Q3) a) What is the necessity of a multistage compression system? Enlist advantages of multistage compression system. **[5]**

b) A two stage compression system with flash gas removal having capacity of 30 TR with is used to achieve a minimum temperature of -20ºC. System uses R22 refrigerant. When the ambient temperature is 40ºC. The flash tank separates dry vapour at 5 bar. Liquid refrigerant from the flash tank is expanded upto -20ºC. Assuming that the refrigerant at the exit of the evaporator is dry and the liquid refrigerant leaving the condenser is saturated liquid. Compression in each compressor is isentropic. Draw P-h diagram. **[10]**

Calculate:

i) Mass flow rate in each cylinder

ii) Power required to run the system

iii) COP of the system.

Use the P-h chart provided.

OR

Q4) a) Explain with schematic and P-h diagram a complete two stage compression system with flash chamber acts as intercooler and gas removal. **[5]**

b) A multi evaporator refrigeration system with R22 as a refrigerant uses two evaporators of capacities 20 TR at 0ºC and 30 TR at -20ºC with a single compressor and individual expansion valve. The condenser is operating at 40ºC temperature. The exit condition of refrigerant from each evaporator is saturated vapour and refrigerant leaving the condenser is saturated liquid. Draw P-h diagram. **[10]**

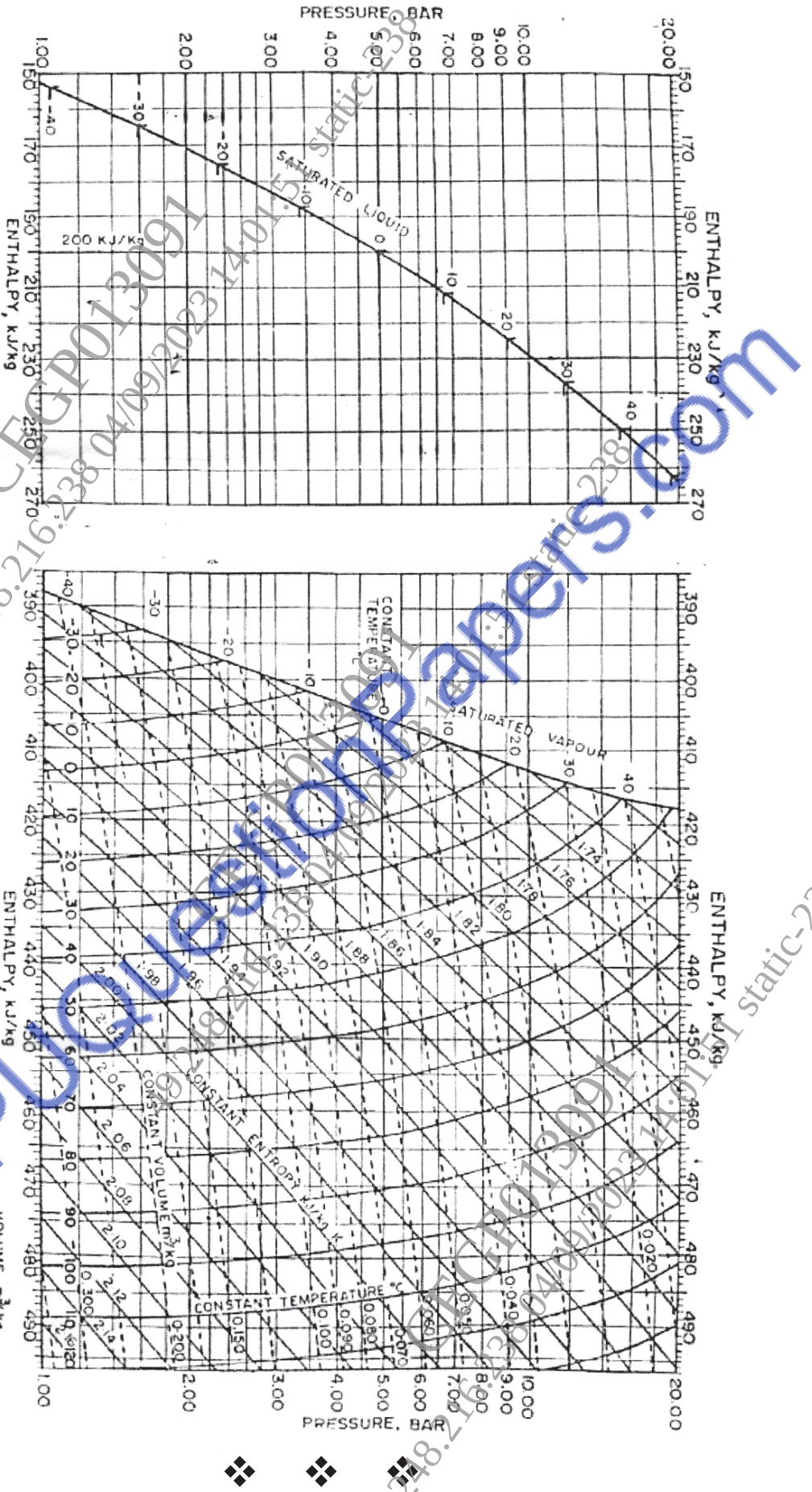
Find :

i) Mass of refrigerant circulated in each evaporator

ii) Power required to drive the system

iii) COP of the system.

Use the P-h chart provided.



PRESSURE – ENTHALPY DIAGRAM, REFRIGERANT 22

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