Total No. of Questions : 4]

SEAT No. :

PC196

[Total No. of Pages :4

[6361]-54

B.E. (Mechanical) (Insem)

HEATING VENTILATION AIR CONDITIONING & REFRIGERATION

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

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

Instructions to the candidates:

1) ***Answer 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 Steam Tables, Mollier charts and electronic pocket calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Explain required physical and chemical properties of refrigerant. **[6]**

b) An aircraft refrigeration plant has to handle a cabin load of 30 tonnes. The atmospheric temperature is 17°C. The atmospheric air is compressed to a pressure of 0.95 bar & temperature of 30°C due to ram action. This air is then further compressed in a compressor to 4.75 bar, cooled in a heat exchanger to 67°C, expanded in turbine to 1 bar pressure & supplied to the cabin. The air leaves the cabin at a temperature of 27°C. The isentropic efficiencies of both compressor & turbine are 0.9. **[9]**

Determine the following,

i) Mass flow rate of air circulated/Seconds

ii) COP

iii) Specific power required.

Take C_p = 1.004 kj/kg-K and Υ = 1.4 for air

Sketch the cycle on T-S diagram.

OR

P.T.O.

Q2) a) Explain with neat sketch the regenerative air refrigeration system. **[6]**

b) A bootstrap cooling system of 10 TR capacity is used in an airplane. The ambient air pressure and temperature are 20°C and 0.85 bar respectively. The pressure of air increases from 0.85 bar to 1 bar due to ramming action of air. The pressure of air discharged from the main compressor is 3 bar. The discharge pressure of air from the secondary compressor is 4 bar. The isentropic efficiency of each compressor is 80%, while that of turbine is 85%. The temperature drop of air in the first and second heat exchanger is 87.85°C and 88.3°C respectively. Assuming the ramming action to be isentropic, the required cabin pressure is of 0.9 bar and temperature of 20°C. Take C_p of air as 1 and $\gamma = 1.4$. **[9]**

Find

i) Draw neat temperature entropy plot of given system.

ii) The power required to operate the system.

iii) The C.O.P. of the system.

Q3) a) Explain the demerits of using a single compressor for a large pressure ratio in refrigeration systems. **[5]**

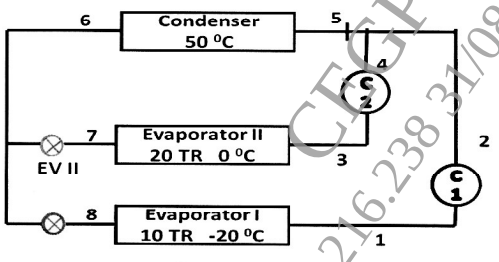
b) A multi evaporator system with individual compressor and an individual expansion valve using R 22 as refrigerant as shown in figure below. Assuming exit of condenser to be saturated liquid and entry to each compressor to be saturated vapour, **[10]**

Find

i) Total power required to run the system in kW.

ii) C.O.P. of system and

iii) Draw neat Log P Vs h plot on the R 22 chart provided and attach as supplement.



8

OR

Q4) a) Explain two fluids cascasde cycle with the help of schematic and p-h diagram. **[5]**

b) Explain following multi-pressure systems with the help of schematic and p-h diagram. Also write formula for COP of the systems. **[10]**

i) Two-evaporator system with single compressor and individual expansion valves.

ii) Two-evaporator system with individual compressor and multiple expansion valve.