Total No. of Questions : 4]

SEAT No. :

P8854

[Total No. of Pages : 5

Oct-22/BE/Insem-54

B.E. (Mechanical)

HEATING VENTILATION AIR CONDITIONING & REFRIGERATION (402041)

(2019 Pattern) (Semester - VII)

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

Instructions to the candidates :

1) ***Answer Q1 or Q2, Q3 or Q4.***
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 the concept of DART in air refrigeration cycles and compare various air refrigeration cycles using DART. **[5]**

b) Explain the following properties of refrigerants : **[10]**

i) Latent heat of vaporization

ii) Boiling point

iii) Miscibility.

iv) Specific heat of vapour refrigerant

v) Critical point

OR

Q2) a) Write note on: (i) ODP (ii) Secondary Refrigerants iii) LCCP **[6]**

b) The following data refers to a bootstrap air cycle evaporative refrigeration cycle used for an evaporator to take 20 tonnes of refrigeration load :

Ambient air temperature = 15°C

Ambient air pressure = 0.8 bar

Mach number of flight = 1.2

Ram efficiency = 90%

P.T.O.

Pressure of air after main compressor = 4 bar

Pressure of air after secondary compressor = 5 bar

Isentropic efficiency of main compressor = 90%

Isentropic efficiency of secondary compressor = 80%

Isentropic efficiency of cooling turbine = 80%

Temperature of air leaving the first heat exchanger = 170 °C

Temperature of air leaving the second heat exchanger = 155 °C

Cabin pressure = 1 bar :

Cabin temperature = 25 °C

Find :

i) Draw neat temperature entropy plot of given system

ii) Temperature of air at the entry of main compressor

iii) Actual pressure of air at the entry of main compressor

iv) Actual temperature of air at the exit of main compressor

Actual temperature of air at the exit of secondary compressor. **[9]**

Q3) a) Explain with schematic and p-h diagram CO_2-NH_3 cascade refrigeration system. **[6]**

b) A R134a refrigeration system works with two evaporators, individual expansion valves, individual compressors and with single condenser find,

i) Mass of refrigerant circulated in each evaporator,

ii) Compressor power for each compressor and total power

iii) COP of the system.

Assume that the refrigerant leaving each evaporator is dry and saturated and the liquid refrigerant leaving the condenser is saturated liquid. Compression is isentropic in each compressor. **[9]**

Draw process on Ph chart provided and attach as supplement

Tempt (°C)	Pressure (Bar)	hf (kJ/kg)	hg(kj/kg)	cooling load
–20	1.350	172	387	4 TR
0	2.90	199	398	2 TR
40	11.00	258	418	-

USe P-h chart to find 'h' at exit of compressor

OR

Q4) a) Explain a two-stage vapour compression cycle with flash chamber for gas removal and intercooling with schematic and P-h diagram. Also write formula to calculate COP. **[6]**

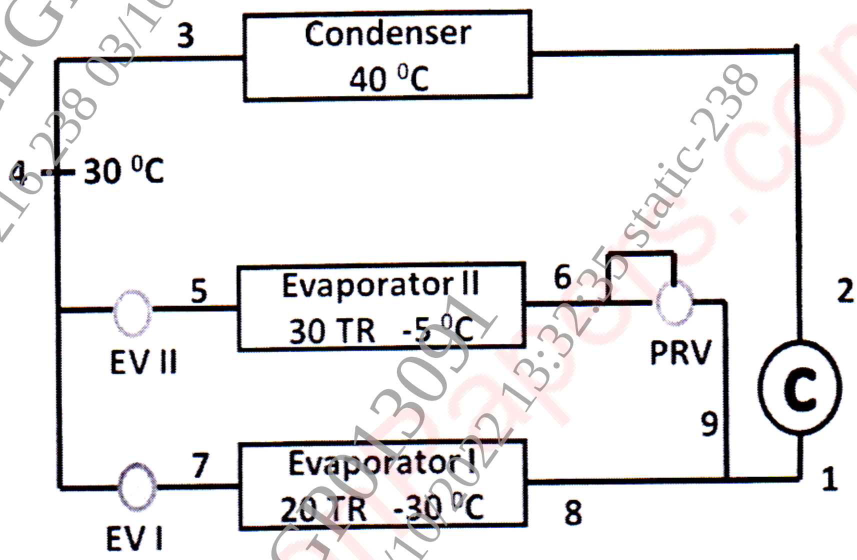
b) A typical multi-pressure system is shown in below figure with R134a as refrigerant in the cycle. Refrigerant is subcooled by 10 °C at the condenser exit. Consider the exit of each evaporator to be saturated vapour. Find **[9]**

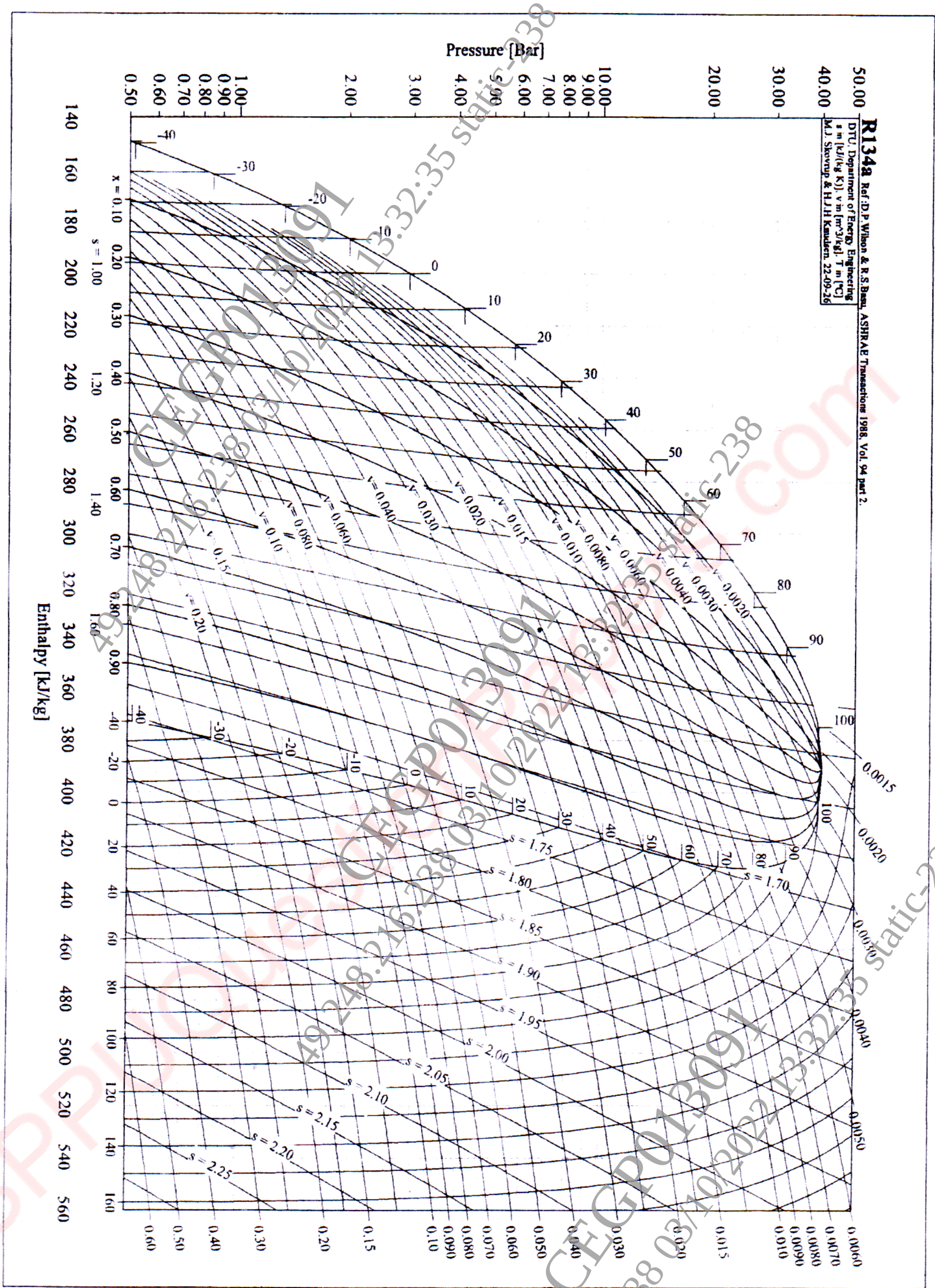
i) Draw neat Log P Vs h plot on the R 134a chart provided and attach as supplement

ii) Mass flow rate through each evaporator

iii) Cooling load on condenser

iv) C.O.P of system


Condenser
40 °C
3
4
30 °C
5
Evaporator II
30 TR -5 °C
6
PRV
2
C
EV II
9
7
Evaporator I
20 TR -30 °C
1
8
EV I


R134a Ref: D.P. Wilson & R.S. Basu, ASHRAE Transactions 1988, Vol. 94 part 2.
DTU, Department of Energy Engineering
s in [kJ/(kg K)]. v in [m^3/kg]. T in [ºC]
M.J. Skovrup & H.J.H Knudsen. 22-09-26
Pressure [Bar]
Enthalpy [kJ/kg]