

Total No. of Questions : 12]

SEAT No. :

P743

[Total No. of Pages : 4

[4659] - 47

B.E. (Mechanical)**ADVANCED AIR CONDITIONING AND REFRIGERATION****(Semester - II) (2008 Pattern) (Part - II) (Elective - III (d))***Time : 3 Hours]**[Max. Marks : 100**Instructions to the candidates:*

- 1) *Answer 3 questions from Section - I and 3 questions from Section - II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

SECTION - I

- Q1)** a) Write a short note on HP/LP receivers. **[6]**
- b) A Freon 22 condensing units is specified to give 40 TR capacity for air-conditioning under standard operating conditions of 60°C condensing and 5°C evaporating temperature. What would be its capacity in TR for food freezing for which the evaporator temperature is -35°C? Also obtain the capacity of air- conditioner for condensing temperature of 40°C. **[12]**

Ts(°C)	h _f (kj/kg)	h _g (kj/kg)	S _f (kj/kg)	S _g (kj/kg)	v(m ³ /kg)
-35	158.76	390.85		1.8140	0.1655
5	194.4	407.15		1.7645	0.04035
40	249.7	415.95	1.1666	1.6995	0.0151
60	276	416.49	1.2504	1.6721	0.0090

P.T.O.

OR

- Q2)** a) Explain actual vapour compression cycle using p-h and T-s diagram. [10]
 b) Explain ejector-expansion transcritical refrigeration cycle. [8]

- Q3)** a) Discuss the various methods of capacity controls of reciprocating compressor. [6]
 b) Design R-22 condenser to meet the following conditions; [10]

Refrigeration load	30 TR
Condensing temperature	55°C
Evaporating temperature	-15°C
Water inlet temperature	27°C
Water flow rate per TR	0.00757 m ³ /min
Heat rejection factor	1.013
Maximum tube length & diameter	3.6576m & 2.54cm
Fouling factor	0.001m ² K/W
HTC inner & outer side respectively	6000 W/m ² .K & 1500 W/m ² .K

State the selection basis of condenser.

OR

- Q4)** a) Explain Pumped circulation system. [6]
 b) A capillary tube in a 2TR R-134a air conditioner has a bore of 3 mm. Saturated liquid from the condenser enters at a temperature of 50°C and flows adiabatically through the tube until its temperature is 0°C. Determine its length. The friction factor is 0.020. Assume intermediate sections at 40, 30, 20 and 10°C [10]

Ts (°C)	Ps (bar)	v _f (kJ/kg) x 10 ³	v _g (kJ/kg)	h _f (kJ/kg)	h _g (kJ/kg)
50	13.18	0.906	0.0150	271.97	430.40
40	10.167	0.871	0.0199	256.43	426.17
30	7.703	0.842	0.0265	241.56	421.43
20	5.718	0.816	0.0358	227.23	416.29
10	4.147	0.793	0.0491	213.39	410.85
0	2.929	0.772	0.0689	200	405.17

- Q5)** a) Explain the construction working of pilot-operated solenoid valve. [6]
 b) Discuss the main characteristics of filter. [6]
 c) Explain the followings; [4]
 i) Motor over current protection
 ii) adjustable speed drives

OR

- Q6)** a) Draw & explain electric circuit for oil pressure failure control. [8]
 b) List the pollutants & contaminants present in the air with source. [4]
 c) Discuss the types of safety valves. [4]

SECTION - II

- Q7)** a) Draw and discuss modified comfort chart. [8]
 b) Explain the ECBC and star rating for air conditioning systems. [8]

OR

- Q8)** a) Explain the term [8]
 i) Sol-air temperature
 ii) Air spaces
 iii) Decrement factor
 iv) Time lag
 b) Discuss inside design conditions of followings with suitable example. [8]
 i) Cold storage
 ii) Industrial air conditioning
 iii) Comfort air conditioning
 List the factors affecting outside design condition.

- Q9)** a) Explain the factors considered in HVAC design of theaters. [8]
 b) A simple F_{12} cycle is used as a heat pump for space heating, providing 100 MJ/hr to the room. The cycle operates between 15 to 50°C
 Determine [10]
 i) The mass flow rate of F_{12}
 ii) Theoretical power required to run the compressor
 iii) The piston displacement of the compressor if the volumetric efficiency is 85%
 iv) The cop of the system.

Use following data.

Enthalpy of F_{12} at suction of compressor (dry and saturated) = 193 kJ/kg.

Enthalpy of F_{12} at delivery of compressor (superheated) = 210 kJ/kg

Enthalpy of F_{12} at outlet of condenser

= Enthalpy at inlet of evaporator = 85 kJ/kg.

OR

Q10)a) Discuss the HVAC design considerations for textile manufacturing plant. **[8]**

b) What are the applications of heat pump? Draw and explain water-to-air heat pump circuit. How air to water heat pump circuit is different from first circuit. **[10]**

Q11)a) Explain the limitations of vapour compression cycle for producing Cryogenics lower temperature. Explain the significance of figure of merit in cryogenic. **[8]**

b) Explain the working principle of liquification of helium. **[8]**

OR

Q12)a) Explain the properties of cryogenics fluids. **[8]**

b) What are the types and materials used for insulation in cryogenics. Specify important features of insulation used in cryogenics. **[8]**

