Total No. of Questions :10]

SEAT No. :

P3669

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[4959] - 1031

B.E. (Mechanical)

REFRIGERATION AND AIR - CONDITIONING

(2012 Course) (Semester - I) (402041)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) What are the limitations of Reversed Carnot cycle? **[4]**

b) Define followings terms: **[6]**

i) ODP

ii) GWP

iii) LCCP

iv) EER

v) SEER

vi) IPLV

OR

Q2) a) Give the layout of an ice - plant and explain briefly how ice is manufactured. **[4]**

b) A Freon 12 Simple Vapour compression system operating at a condenser temperature of 40°C and an evaporator temperature of 0°C develops 15 tons of refrigeration. Using the P- h diagram for Freon 12, Determine; **[6]**

P.T.O.

i) The discharge temperature and mass flow rate of refrigerant circulated.

ii) The theoretical piston displacement of the compressor and piston displacement per ton of refrigeration.

iii) The theoretical horse power of the compressor and horse power per ton of refrigeration.

iv) The heat rejected in the condenser

v) The Carnot COP and actual COP of the cycle.

Q3) a) Discuss why refrigerators are so selected that evaporator pressures and condenser pressures are greater than atmospheric pressure? **[4]**

b) Mention the function of each fluid in a three fluid vapour absorption system. **[6]**

OR

Q4) a) Draw neat compact diagram of Lithium bromide water absorption refrigeration system and explain its working. List out the major fields of application of this refrigeration system. **[6]**

b) Draw a vapour compression system having individual compressors with compound compression and flash intercooling. **[4]**

Q5) a) Moist air at standard atmospheric pressure is passed over a cooling coil. The inlet state - DBT 30°C, RH 50% and exit state - DBT 15°C, RH 90%. Show the process on psychrometric chart. Determine the amount of heat and moisture removed per kg of dry air. **[6]**

b) Calculate:

i) Relative humidity

ii) Humidity ratio

iii) Dew point temperature

iv) Density

v) Enthalpy of atmospheric air when the DBT is 35°C, WBT is 23°C and barometer reads 750 mm of Hg. **[10]**

OR

Q6) a) Derive an expression for specific humidity and show that it is a function of vapour pressure and barometric pressure of air. **[6]**

b) A building has the following calculated cooling loads: **[10]**

RSH gain = 310 kW, RLH gain = 100kW

The space is maintained at the following conditions:

Room DBT = 25°C, Room RH = 50%

Outdoor air is at 28°C and 50% RH. And 10% of mass of air supplied to the building is outdoor air. If the air supplied to the space is not to be at a temperature lower than 18°C, Find:

i) Minimum amount of air supplied to space in m^3/s.

ii) Volume flow rates of return air, exhaust air and outdoor air

iii) State and volume flow rate of air entering the cooling coil

iv) Capacity, ADP, BPF and SHF of cooling coil

Q7) a) State the factors which should be taken into consideration while selecting a system of air-conditioning. **[6]**

b) Explain briefly the following control devices: **[8]**

i) Thermostats

ii) Automatic humidity control

iii) Air movement control

iv) Automatic temperature control

c) Enumerate the functional elements of a control unit. **[4]**

OR

Q8) a) Explain briefly the following types of reciprocating compressors: **[6]**

i) Open type vertical reciprocating compressor

ii) Semi sealed type

iii) Hermetically sealed type

b) Give the main types of condensers in use with specific application of each type. **[6]**

c) Explain with neat sketches the following evaporators: **[6]**

i) Flooded type evaporator

ii) Dry expansion evaporator

Q9) a) Define the following as applied to 'Air distribution': **[8]**

Intake, Outlet, Grille, Register, Diffuser, Throw, Drop and Primary air.

b) The main supply air duct of an air - conditioning system is 100cm X 90 cm in cross section and carries $10m^3/s$ of air. It branches off into two ducts, one 80cm X 80cm and the other 80cm X 60 cm, if the mean velocity in the larger branch is 9m/s, find the mean velocities in the main duct and smaller branch. **[8]**

OR

Q10)a) Explain any two of the following air distribution system: **[6]**

i) Ejector system

ii) Downward system

iii) Upward system

b) A centrifugal fan with 90cm X 70cm outlet is moving standard air at a rate of $11.5m^3/s$ through a system which consists of straight inlet and outlet ducts. The inlet duct is 90 cm in diameter and 15m long. The outlet duct is 100cm in diameter and 60m long. There is a fan diffuser between the fan discharge and the 100cm diameter duct for which the pressure loss is one third the difference in velocity pressures. The pressure drop at the filter, damper and cooling coil in the inlet duct is 15mm H_2O. The loss at the entry to the inlet is 0.5 X velocity pressure. The friction factor for the outlet duct is 0.0035 and that for the inlet duct is 0.004.

i) Determine the fan total pressure

ii) Determine the static pressures at fan inlet and outlet

The air is sucked in by the inlet duct and delivered by the outlet at atmospheric pressure. **[10]**

Pressure-enthalpy diagram for Freon 12