Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(Marine Engineering) (2013 Batch) (Sem.–7)

REFRIGERATION AND AIR CONDITIONING

Subject Code : BTME-804

Paper ID : [74248]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q.1 Answer briefly :

a) Define Air Conditioning.

b) Define ton of refrigeration.

c) Explain the effect of flash intercooling on performance of vapour compression refrigeration system.

d) Enumerate the desirable properties of refrigerant in vapour absorption refrigeration system.

e) Enumerate the effects of oil miscibility on performance of refrigeration systems.

f) Enumerate the steps involved in charging of refrigeration system.

g) Differentiate between azeotropes and zeotrope refrigerants.

h) Enumerate the desirable characteristic properties of refrigerants used in refrigeration systems.

i) Differentiate between industrial and comfort air conditioning.

j) Enumerate various types of expansion devices used in refrigeration and air conditioning systems.

SECTION-B

Q.2 A reversed Carnot cycle working as heat pump is delivering 40000 kJ/min to heat the conditioned space & maintaining it at 25°C when the outside temperature of atmosphere is 15°C. Determine the heat absorbed from the atmosphere air and the power required to operate the cycle. If the same space is to heated by electric coil heaters, determine the power consumed by the electric heater.

Q.3 A dense closed cycle refrigeration system working between 4 bar and 16 bar extracts heat at the rate of 126 MJ / hour. The air enters the compressor at 5°C and expander at 20°C. Assuming that the unit runs at 300 rpm, determine: power required to run the unit, COP of unit, bore of compressor, refrigeration capacity in TR. The expander and compressor are double acting and stroke for compressor and expander is 300 mm. The mechanical efficiency of the compressor is 80%. The mechanical efficiency of expander is 85%. Assume that the compression and expansion are isentropic.

Q.4 A simple R-134a heat pump for space heating operates between temperature limits of 15°C and 50°C. The heat required to be pumped in the conditioned space is 100 MJ/hour. Determine the mass flow rate of the refrigerant, theoretical piston displacement of the compressor, power required to drive the compressor and COP of the system. Assume (C_{Pv}) = 0.996 kJ/kg K and specific volume of R-134a saturated vapor at 15°C as 0.04185 m^3/kg.

Q.5 Explain the principle of vapour absorption refrigeration system. Discuss the working of Lithium bromide - Water vapour absorption refrigeration system by giving a neat sketch.

Q.6 From a given sample of atmospheric air at 35°C and 60% R.H., 0.0078 kg of moisture per kg air are removed. After removing moisture the temperature reduces to 22°C. Determine relative humidity and dew point temperature.

SECTION-C

Q.7 a) The following data refers to a two stage compression with multiple expansion valves and flash inter-cooling: Condenser pressure: 9.634 Bar; Evaporator pressure: 1.828 Bar; Mass flow rate of refrigerant through evaporator: 0.2 kg/sec; intermediate pressure: 4.238 Bar; Refrigerant: R-12. Obtain the COP and capacity of the system and compare with a corresponding single-stage system operating between the above pressure limits.

b) Briefly describe the Vortex tube refrigeration system giving a neat sketch.

Q.8 a) Explain the differences between theoretical and practical vapour compression refrigeration systems by giving P-h and T-s diagrams.

b) Describe the ill effects of conventional refrigerants on environment. How these ill effects can be effectively mitigated?

Q.9 The following data refer to summer air-conditioning of a building :

Outside design conditions: 43°C DBT & 27°C WBT, Inside design conditions: 25°C DBT & 50% R.H, Room sensible heat gain: 84000 kJ/hr, Room latent heat gain: 21000 kJ/hr

Bypass factor of cooling coil used: 0.2, The return air from the room is mixed with the outside air before entry to cooling coil in the ration of 4:1. Determine apparatus dew point of the cooling coil, entry & exit conditions of air for cooling coil, fresh air mass flow rate, and refrigeration load on the cooling coil.