TME-605 373

Even Semester Examination - 2017

B.TECH. (VI SEMESTER)

REFRIGERATION AND AIR CONDITIONING

Time: 03:00 Hours **Max Marks : 100**

Note: Attempt **all** questions, each question carry **equal** marks.

1. Attempt any four parts of the following: (5 × 4 = 20)

a) What is the importance of refrigeration and which are the different methods of producing refrigeration? Also define unit of refrigeration.

b) What is the basic difference between open and closed Air refrigeration cycles?

c) Discuss the effect of variation of evaporator and condenser temperatures on COP of Carnot cycle.

d) How a Carnot cycle is used as a refrigeration cycle, and what is the value of C.O.P. of a Carnot refrigeration cycle in terms of higher and lower temperatures?

e) An air refrigeration system following Bell Coleman cycle is operating between pressure limits of 1.05 bar and 10 bar respectively. Air is drawn from the cold chamber at 11°C and after compression it is cooled to 30 °C, before entering the expansion cylinder. If expansion and compression process follow the law $PV^{1.28}$ = constant, determine the theoretical C.O.P. of the above refrigeration system.

f) A gas refrigeration system working on reversed Brayton cycle as air as a working fluid. If temperature at the end of heat absorption and the end of heat rejection are 0 °C & 30 °C respectively and pressure ratio is 4. Determine the temperature at all points and also find volume flow rate at the inlet of the compressor and exit of the expander. The cooling capacity of plant is 1 TR and pressure at the inlet to the compressor is 1 bar.

2. Attempt any four parts of the following: (5 × 4 = 20)

a) What are the main characteristics of a vapour compression refrigeration system and what are its

advantages over air refrigeration system. Draw a single stage simple vapour compression refrigeration cycle on (T-S) and (P-H) diagrams.

b) What do you understand by multistage compression and why it is required in a system when the difference between the evaporator and condenser pressures is large?

c) In a 5 kW cooling capacity refrigeration system operating on simple vapour compression refrigeration cycle. The refrigerant enters the evaporator with an enthalpy of 75 kJ/kg and leaves with an enthalpy 183 kJ/kg. The enthalpy of refrigerant after compression is 210 kJ/kg. Calculate COP and the rate of heat transfer in condenser in kJ/sec.

d) Explain the purpose of "Capillary Tube", "Filter", "Drier", and "Receiver" in a vapour compression refrigeration system.

e) Using schematic and P-h diagram, explain working of cascade refrigeration system. Compare it with multi stage system.

An ice making plant using R-12 is having an evaporation saturation temperature -25 °C and condenser saturation temperature of 35 °C. The vapour is leaving the compressor at 65°C. Enthalpy of superheated refrigerant at 850 kPa & 65°C is 225.5 kJ/kg. calculate:

(i) The COP

(ii) If the capacity of plant is 5 kW, calculate mass flow rate of refrigerant and power consumption in kW.

T (°C)	P (kPa)	h_f (kJ/kg)	h_g (kJ/kg)
-25	123.7	13.3	176.5
35	850	69.6	201.5

Attempt any two parts of the following: $(10 \times 2 = 20)$

a) What is the basic difference between a vapour absorption refrigeration system and a vapour compression system? Explain how, the function of the compressor in vapour compression system is achieved in a vapour absorption system, and by which components?

b) In a vapour absorption refrigeration system, the generator is operated by solar heat where the temperature achieved is 100 °C. If the evaporator temperature is -10°C and the condenser / absorber temperature are 35°C, what is the maximum possible C.O.P. of the system?

c) Give classification and nomenclature of refrigerants in detail. Discuss the effects of CFC refrigerants on Ozone layer briefly.

4. Attempt any two parts of the following: (10 × 2 = 20)

a) (i) Define "Relative Humidity" and "Degree of Saturation" and derive a relation between them. Derive an expression for by-pass factor.

(ii) What do you understand by enthalpy deviation lines, adiabatic saturation of air.

b) Air at 32 °C DBT and 20 °C WBT is passed through a cooling coil maintained at 5 °C. The heat extracted by the cooling coil from air is 14 kW and air flow rate is 42.5 m^3/min. Determine: (a) DBT and WBT of the air leaving the coil (b) Coil by-pass factor.

c) A mixture of dry air and water vapour at a temperature of 22 °C under a total pressure of 730 mm of Hg. The dew point temperature is 15 °C. Find: (i) partial pressure of water vapour (ii) relative humidity (iii) specific humidity (iv) enthalpy of air per kg of dry air (v) specific volume of air per kg of dry air.

5. Attempt any two parts of the following: (10 × 2 = 20)

a) *With the help of suitable diagram explain the* working of an air washer. Also represent the process on a Psychrometric chart.

b) Describe various types of cooling towers with the help of neat sketches.

c) Enlist various refrigeration equipments used in a vapour compression refrigeration system. Which are the different types of compressors generally used in refrigeration and air conditioning units?

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