Roll No.

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Examination May-2014

B.Tech

Heat Exchangers & Air Conditioning (AE-307)

Paper ID- A0716

Time allowed: 3Hrs **Max.Marks:60**

NOTE: Attempt all sub parts of the sections at same place & Use of charts/ table is allowed

SECTION-A (All questions compulsory) **10X2=20**

Q.1 (i) Write short note on compact heat exchanger and regenerators.

(ii) Draw temperature vs. length profile for condenser, evaporator and for counter flow heat exchanger with Ch = Cc

(iii) Write a short note on NTU method for heat exchanger analysis.

(iv) What are the limitations of the reversed Carnot cycle if it is used for refrigeration?

(v) Which refrigerants require centrifugal compressor? Where these refrigerants are used in practice.

(vi) Compare the performance of the reciprocating and centrifugal compressors.

(vii) What is the necessity of the expansion valve in the refrigeration system? Explain the working of thermostatic expansion valve with the help of diagram.

(viii) Define the followings: relative humidity, degree of saturation, humid specific heat, WBT

(ix) What is by-pass factor and efficiency of the coil? How it is related to by-pass factor

(x) What is grand sensible heat factor (GSHF) & Effective room sensible heat factor (ERSHF)?

SECTION-B (Attempt any four questions) **4X5=20**

Q.2 Explain the working with neat diagram of the following type condenser (i) shell and coil condenser (ii) doubled type water cooled condenser

Q.3 Derive an expression for the logarithmic mean temperature difference (LMTD) in case of counter flow heat exchanger

Q.4 Prove the relationship between degree of saturation and relative humidity as:

$\Phi = \mu P_v/(P_t-(1-\mu)P_{vs})$, where Φ is RH & μ is degree of saturation, Pt is total pressure& Pvs is partial vapour pressure

Q.5 $40m^3$ of air per minute at 31°C and 18.5°CWBT is passed over the cooling coil whose surface temperature is 4.4°C. The coil cooling capacity is 3.56 tons of refrigeration under the given condition of air. Determine DBT and WBT of the air leaving the cooling coil.

Q.6 a single cylinder single acting reciprocating compressor has bore 18 cm and the stroke 27cm. It receives vapour at 1 bar and delivers at 5 bar. The clearance is 5% of the stroke volume,

determine; power required to run the compressor, volumetric efficiency of the compressor, assume that compression and expansion follows the law $pv^{1.25} = C$

SECTION-C (Attempt any two questions) **10X2=20**

Q.7 A one shell two tube pass heat exchanger having 3000 thin wall brass tubes of 20mm diameter has been installed in power plant with a heat load of 230MW. The steam condenses at 50 °C and the cooling water enters the tube at 20 °C at the rate of 3000 Kg/s. Calculate overall heat transfer coefficient, tube length per pass and the rate of condensation of the steam. Take heat transfer coefficient for the condensation on the outer surface as 15.5KW/m^2K and the latent heat of the steam as 2380KJ/Kg. Further assume the following properties as: Cp = 4.180KJ/Kg K, $\mu = 855X\ 10^{-6}$ Ns/m^2, K =0.613W/m K and Pr = 5.83

Q.8 Design the air conditioning system for a ant when following data is available: Total heat flow through the walls, roof and floor 21200KJ/hr. Solar heat gain through the glass 6800KJ/hr, Equipment sensible heat gain 10,000KJ/hr, Equipment latent heat gain 400KJ/hr. Total infiltrated air 400 m^3/hr. Outdoor conditions 35°CDBT and 26°CWBT, Inside design conditions 27°CDBT and 55% RH, Minimum temperature of the air supplied to the room 17°C DBT, total amount of the fresh air supplied 1600m^3/hr. The seating chairs for dinning 100, employees serving the meal 10. Total sensible and latent heat added because of these people is 22750KJ/hr and 10300KJ/hr. Determine the followings:(i) Amount of the air delivered to the room in cum. per hour (ii) Percentage of the recirculated air (iii) Refrigeration load on the cooling coil in tons of refrigeration (iv) also find the DPT of the cooling coil and By Pass factor

Q.9 Discuss in detail with neat and clean diagrams, about duct system used in air conditioning and automotive air conditioning systems.

End