

3177-11.

(REVISED COURSE)

RK-3267

(3 Hours)

[Total Marks : 100

- N. B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from remaining **six** questions.
 (3) **Use** of Psychrometric charts and tables, Friction chart and Steam table is **permitted**.
 (4) **Clearly** mention the assumptions made if any.

1. Attempt any **four** :— 20
- Need for aircraft air refrigeration system. Discuss.
 - Discuss the effect of liquid subcooling and suction vapour superheater on performance of vapour compression cycle.
 - Discuss the importance of vapour absorption system and ammonia water system.
 - Describe the friction chart for duct design.
 - What is human comfort and comfort chart ?
 - What are different types of cooling towers and tower efficiency ?
2. (a) A vapour compression refrigeration system operates between the evaporating and condenser temperature of 258 k and 313 k, respectively. 12
 Calculate :—
- tonnage
 - Volume handled by compressor
 - COP and heat transfer to condenser.
- The compressor power input is 10 kW.
 The refrigerant used is R-22 and enthalpy at the end of isentropic compression is $h_2 = 287.07$ kJ/kg.
- (b) Explain Boot strap air refrigeration cycle with neat schematic and T-S diagrams. 8
3. (a) The following data refer to a reduced ambient refrigeration system. Pressure of ram air 1.1 bar at 20°C. Pressure at the end of the main compressor 3.3 bar. 12
 Obtain :—
- COP
 - Tonnage and
 - Power needed to operate the system for the following data :—
- Main compressor efficiency, $\eta_c = 0.8$.
 Heat exchange effectiveness = 0.8.
 The pressure at the exit of the auxilliary turbine 0.8 bar (Efficiency = 0.85).
 Temperature of the air leaving cabin = 25°C.
 Pressure in the cabine = 1.013 bar.
 Flow rate of air through cabin = 1.0 kg/s
 Auxilliary turbine efficiency = 0.8.
- (b) Discuss the effect of change in evaporator and condensor pressure on the performance of standard vapour compression cycle with the help of P-h diagram. 8

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4. (a) The following data refer to a vapour absorption system :—
 Generator temperature = 117°C .
 Condenser (absorber) temperature = 37°C .
 Evaporator temperature = -15°C .
 If the actual COP is 50% of the ideal COP of the system, get the amount of saturated steam supplied to generator at 130°C for 100 ton capacity if condensate leaves the generator at 120°C .
 (b) Discuss various Psychrometric processes in air conditioning system by using an air washer. 10
5. (a) Air at $T_{db} = 30^{\circ}\text{C}$ and $\text{RH} (\phi) = 40\%$ undergoes a constant humidity process until the final state is 20°C . Find :— 8
 (i) Enthalpy of air at final state.
 (ii) Cooling produced by the coil.
 (b) Discuss primary and secondary refrigerant with few example in each case. 6
 (c) Explain the working of thermostatic expansion valve. 6
6. (a) The total room cooling load was estimated to be $1,40,000 \text{ kJ/h}$ when the ambient and inside design conditions are $T_{db} = 40^{\circ}\text{C}$ and $T_{wb} = 30^{\circ}\text{C}$ and $T_{db} = 27^{\circ}\text{C}$ and $\phi(\text{RH}) = 60\%$ respectively. 12
 The bypass factor for the cooling coil is 0.14 and Apparatus Dew Point (ADP) being 4.5°C lower than the dew point temperature corresponding to the room design condition. Find :—
 (a) ADP
 (b) Volume of air supplied to the room and
 (c) Tonnage of cooling coil.
 (b) Explain the working of house hold refrigerator. 8
7. Write short notes on any **four** of the following :— 20
 (a) Control used in Air conditioning system.
 (b) Design of winter and summer Air conditioning system.
 (c) Designation system of Refrigerants.
 (d) Commercial ice making plant.
 (e) Manufacturing of dry ice.
 (f) Window Air conditioner.