

SUBJECT CODE NO:- P-283
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Mech.) Examination May/June 2017
Refrigeration and Air Conditioning
(Revised)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- 1) Solve three questions from each section.
 - 2) Figure to the right indicate full marks
 - 3) Use of refrigerant table, steam tables and psychrometric charts is allowed.
 - 4) Assume suitable data necessary.

Section A

- Q.1 a) Discuss the limitation of Carnot cycle used for refrigeration. 03
b) Explain the Ton of refrigeration and show it is equivalent to 3.5 Kw. 03
c) The capacity of a refrigerator is 300 TOR when working between -10°C and 25°C . Determine the mass of 06 ice produced per day from water at 25°C . Also find the power required to drive the unit. Assume that the cycle operates on reversed Carnot cycle and latent heat of ice is 335 kJ/kg.
- Q2 An ammonia ice plant operates on simple saturation cycle at the following temperatures: Condensing 12
tempt. = 40°C , Evaporating tempt. = -15°C . It produces 50 tons of ice per day at -5°C from water at 30°C . Determine a) Capacity of the refrigeration plant, b) Mass flow rate of refrigerant, c) Compressor dimensions if it volumetric is 75% speed is 1500 rpm & L/D ratio is 1.2, e) C.O.P.
- Q.3 A two stage R-22 vapour compression system operates under the following conditions: Evaporator 12
temperature -20°C , condenser temperature 50°C . Minimum temperature difference at heat exchanger for effective is 10°C . The capacity of plant is 10 TOR. The system uses flash intercooler. Assume no superheating in the evaporator & no sub cooling in the condenser. The system is designed for maximum efficiency. Determine:
i) Pressure in flash intercooler
ii) Mass flow rates of refrigerants in LP and HP circuits
iii) Power required
iv) C.O.P.
- Q.4 A boot – strap cooling system of 20 TOR capacity is used in an aero plane. The ambient air temperature 13
and pressure are 20°C and 0.85 bar respectively. The pressures of air increases from 0.85 bar to 1 bar due to ramming action of air. The pressure of air discharged from the main compressor is 3 bar. The discharge pressure of air from the auxiliary compressor is 4 bar. The isentropic efficiency of each of the compressor is 80% while that of turbine is 90%. 50% of the enthalpy of air discharged from the main compressor is removed in the first heat exchanger and 30% of the enthalpy of air discharged from the auxiliary compressor is removed in the second heat exchanger using rammed air. Assuming ramming action to be isentropic, the required compressor pressure of 1 bar and temperature of the air leaving the cabin not more than 20°C ,

- Find : 1. The power required to operate the system; and
2. The C.O.P. of the system.

Draw the schematic and temperature – entropy diagram of the system. Take γ and $C_p=1$ kJ/kgK.

- Q.5 Write short note on the following (any three) 15
- Cascade refrigeration system.
 - Necessity of air-cooling in aero plane.
 - Methods to improve C.O.P. of VCC.
 - Bell-Coleman cycle.
 - Limitations of Carnot cycle used for refrigeration.

Section B

- Q.6 a) Distinguish between vapour absorption refrigeration system with vapour compression refrigeration system. 06
b) Explain Lithium – Bromide water vapour absorption system with neat sketch. 06
- Q.7 a) What is secondary refrigerant? Where is it used? Explain its importance in ice manufacturing plant? 06
b) Explain the factors considered for selection of refrigerant? 06
- Q.8 a) Explain sling psychrometer with neat sketch 04
b) The following reading were taken from a single sychrometer. Dry bulb temperature 30°C, WBT 20°C barometer reading 720mm of hg. Using steam table determine. 08
- Dew point Temp.
 - Relative humidity
 - Specific humidity
 - Degree of saturation.
- Q.9 An air conditioned hall is to be maintained at 25°C dry bulb temperature and 18°C wet bulb temperature. It has a sensible heat load of 50 KW and latent heat load of 20KW. The air supplied from outside atmosphere at 40°C dry bulb temperature and 28°C wet bulb temperature is 30 m³/min directly in to the room through ventilation and infiltration. Outside air to be conditioned is passed through cooling coil whose apparatus dew point is 15°C. The quantity of recalculated air from the hall is 60%. This quantity is mixed with conditioned air after the cooling coil. Determine, 1. Conditions of air after the coil and before the recirculated air mixes with it. 2. Conditions of air entering the hall i.e. after mixing recirculated air, 3. Mass of fresh air entering the cooler, 4. Bypass factor of the cooling coil and refrigerating load on the cooling coil. 13
- Q.10 Write short note on the following (any three): 15
- GWP and ODP.
 - Central air conditioning
 - Ice plant.
 - Steam jet air conditioning system.
 - Window air conditioning system.

CHART C-11
PSYCHROMETRIC CHART
 Barometric Pressure 1.0131 bar (760 mm Hg)

