# SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

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**Total number of questions:09**

## B.Tech. – ME 6$^{th}$Semester
# Refrigeration and Air-conditioning
### Subject Code : ME-304
### Paper ID :

Time allowed: 3 Hrs                                      Max Marks: 60

**Important Instructions:**
- Section A is compulsory
- Attempt any four questions from section B
- Attempt any two questions from section C
- Assume, if any additional data is required but justify the same.
- Use of steam tables, refrigerant tables and psychrometric chart is allowed.

## PART A (2×10)

Q. 1: Answer in brief:

(a) Define TON/TR of refrigeration and convert it into kW.

(b) What are limitations of reversed Carnot cycle?

(c) Define "Dry Air Rated Temperature".

(d) What do you understand by degree of super heat in Vapour compression refrigeration cycle?

(e) Show two stage vapour compression cycle with flash gas intercooling on p-h diagram.

(f) Get chemical formula of R134a.

(g) Write only name of four physical properties of refrigerants.

(h) What is cryogenics?

(i) Define dry bulb temperature and degree of saturation.

(j) Where is evaporative condenser used?

## PART B (5×4)

Q. 2: If any aeroplane moves at velocity of 1200 km/hr, find the temperature rise of the air or surface at stagnation point.

Q. 3: Explain simple vapour compression refrigeration cycle using schematic, p-v, T-s & p-h diagrams.

Q. 4: Describe vortex tube refrigeration system with neat sketch.

Q. 5: Explain the Electrolux refrigerator with neat schematic diagram.

**Q. 6:** 100 m³ of air per minute at 30°C DBT and 60% R.H.is cooled to 20°C DBT by passing through a cooling coil. Find (a) capacity of cooling coil in tons of refrigeration (b) R.H. and WBT of air after cooling coil. Take atmospheric pressure is equal to 1 bar. .

## PART C (10×2)

**Q. 7:** A 5 ton Freon-12 refrigeration plant has saturated suction temperature of -5°C. The condensation takes place at 32°C and there is no under-cooling of refrigerant liquid. Assuming isentropic compression, find:

(i) COP of the plant, (ii) Mass flow rate of refrigerant,

(iii) Power required to run the compressor in kW.

Take the following properties of F-12:

| P (bar) | T (°C) | $h_f$ (kJ/kg) | $h_g$ (kJ/kg) | $S_g$ (kJ/kg-K) |
|---------|--------|---------------|---------------|-----------------|
| 7.85 | 32 | 130.5 | 264.5 | 1.542 |
| 2.61 | -5 | - | 249.3 | 1.557 |

Take $C_p$ (superheated vapour) = 0.615 kJ/kg-K.

**Q. 8:** An air conditioned space is maintained at 26°C DBT and 50% R.H. when the outdoor conditions are 35°C DBT and 28°C WBT. The space has a sensible heat gain of 17.6 kW and the air to the space is supplied at a condition of 8°C saturated. Determine

(i) the mass and volume flow rate of air supplied.

(ii) latent heat load in the room.

(iii) the cooling load of refrigerator plant if 15% of total weight of air supplied to the space is fresh air and the remaining air is recirculated.

**Q. 9:** Write short note on any two of the following:

    (a)     Joule-Thomson coefficient and throttling of real gases.

    (b)     Thermostatic expansion valve with schematic diagram.

    (c)     Flooded evaporator with schematic diagram.