B. Tech.

(SEM. VI) EXAMINATION, 2006-07

REFRIGERATION & AIR CONDITIONING

Time : 2 Hours] [Total Marks : 50

Note : Attempt all questions.

1. Attempt any four parts of the following:

   (a) Explain the following terms:

      (i) Refrigerating effect

      (ii) ton of refrigeration

      (iii) co-efficient of performance

   (b) An ice plant produces 10 tonnes of ice per day at 0°C using water at room temperature of 20°C. Estimate the power of the compressor motor if the co-efficient of performance of the plant is 2.5 and overall electromechanical efficiency is 0.9. Take latent heat of freezing of water as 335 kJ/kg and specific heat of water as 4.18 kJ/kg°C.

   (c) The capacity of a refrigerator operating on reversed Carnot Cycle is 200 TR when working between – 6°C and 25°C. Determine the power required to drive the unit.
(d) Prove that the COP of a Bell-Coleman cycle refrigeration system is given by \( \frac{T_2}{T_3 - T_2} \) where

\( T_2 \) and \( T_3 \) are the temperatures of air at the inlet and discharge of the compressor respectively.

(e) In an ammonia vapour compression system the pressure in the evaporator is 2 bar. Ammonia at evaporator’s exit is 0.85 dry and at entry its dryness fraction is 0.19. During compression the work done per kg of ammonia is 150 kJ. Calculate the COP and volume of vapor entering the compressor per minute if the rate of ammonia circulation is 4.5 kg/min. The latent heat and specific volume of ammonia at 2 bar are 1325 kJ/kg and 0.58 m³/kg respectively.

(f) With the help of neat diagram explain the working of a vapour absorption refrigeration system

2 Attempt any four part of the following:

(a) Draw a neat diagram of Electrolux refrigeration system and explain its working.

(b) Explain clearly the principle of steam jet refrigeration system. What refrigerant is used for this refrigeration system?

(c) Describe the merits and demerits of thermoelectric refrigeration system over other refrigeration system. What are the field of its application?

(d) Explain the principle of working of vortex tube for refrigeration purpose. Where vortex tube refrigeration is used and why?

(e) Sketch and explain a cascade refrigeration system. Where this system is needed for refrigeration?
(f) Explain the importance of Joule Thompson coefficient and inversion temperature when operating a system for liquification of gasses.

3 Attempt any two of the following:
(a) Explain the process of cooling with adiabatic humidification. How this is achieved in practice?
(b) With the help of a labelled diagram describe a year round air conditioning system.
(c) Explain clearly the different stages of human body defence against variations of weather conditions during summer and winter.

4 Attempt any two of the following:
(a) What do you understand by the term cooling load? Explain the different factors considered in load estimation for comfort application.
(b) A refrigeration plant is required to store 20 tonnes of fish. The fish is supplied at a temperature of 30°C. The specific heat of fish above freezing point is 2.93 kJ/kg°C, while that below freezing point it is 1.26 kJ/kg°C. The fish is stored in a refrigerated space which is maintained at –8°C. The freezing point of fish is –4°C. The latent heat of fish is 235 kJ/kg. Compute the product load in kJ.
(c) Describe the different methods of air conditioning duct design. Why are dampers required in some systems?