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# AU/ME-8002 (CBGS)

## B.E., III Semester

Examination, May 2019

## Choice Based Grading System (CBGS)

## Refrigeration and air conditioning

***Time : Three Hours***

***Maximum Marks : 70***

***Note:*** i) Attempt any five questions.

ii) All questions carry equal marks.

iii) Use of refrigeration property table and psychometric chart is permitted.

1. a) Sketch the schematics of refrigeration system operating on Bell-coleman cycle and explain its working. Represent the process on P-V and T-S plots

   b) Define the following term :

      i) Refrigeration

      ii) Refrigeration effect

      iii) Ton of refrigeration

2. A simple saturation cycle using F-12 as refrigerant has been designed to produce 10 tons of ice per day from water at 35°C to ice at –5°C. For effective heat transfer at evaporator and condenser units, a temperature difference of atleast 10°C is required to be maintained. Using P-h chart determine:

   i) Mass flow of refrigerant

   ii) Power required to run the plant









   iii) Cylinder dimension assuming length/diameter ratio of 1.0 for a single cylinder, single acting compressor if its runs 1200 revolution per minute and has a volumetric efficiency of 90%.

   How COP of this system compares with that of Carnot cycle?

   Given: latent heat of ice = 335kJ/kg and specific heat of ice = 1.92kJ/kg K.

3. a) Explain the desirable properties of refrigerants.

   b) What is simple vapour absorption system? State how its performance can be improved.

4. a) An air water mixture at 20°C and 760mm mercury has a relative humidity is 70%. Determine

      i) Partial pressure of vapour and air

      ii) Humidity ratio

      iii) Saturation ratio

      iv) Dew point

      v) Density of mixture

   b) Define and explain the dry bulb, wet bulb and dew point temperatures. 

5. Determine the sensible heat factor and capacity of a refrigeration system to be installed for a bank building to be designed for 100 persons. The pertinent data is stated as

   Outside ambient condition = 40°C DBT and 26°C WBT

   Inside conditions = 22°C DBT and 55%RH

   Building size = 20m×15m×5m high

   Number of changes for infiltration load = 2.8 per 24 hour

   Ventilation air = $4.7\times10^{-3}$ $m^3/s$ per person

   Electrical load = 11500 kJ/hr

Latent and sensible heat release per person = 625 kJ/hr and 420 kJ/hr

Overall heat transfer coefficient for wall and ceiling = 18kJ/$m^2$ hr and 10.5 kJ/$m^2$ hr K

6. a) An air refrigeration open system operating between 1 MPa and 100 kPa is required to produce a cooling effect of 2000kJ/min. The temperature of air leaving the cold chamber is –5°C and at leaving the cooler is 30°C. Neglecting losses and clearance in the compressor and expander, determine:
   i) Mass of air circulated per hour
   ii) Compressor work, expander work and cycle work,
   iii) Coefficient of performance and the power required to run the machine.
   b) For a vapour compression machine, explain the effect of under cooling and superheating on coefficient of performance.

7. a) Discuss with neat sketch the Electrolux refrigerator.
   b) Enumerate and explain the component of internal heat gain during air conditioning.

8. Write a short notes on the following:
   a) Throttling
   b) Effect of condenser and evaporator pressure in VCRs
   c) Human comfort

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