CODE NO:- Z-285

FACULTY OF ENGINEERING & TECHNOLOGY
B.E (Mech) Examination - June – 2015
Refrigeration and Air Conditioning
(Old)

[Time: Three *Hours*]   [Max. Marks: 100]

"Please check whether you have got the right question paper."

N.B   i) Attempt any three questions from each section.
               ii) Use of refrigeration tables, p-h charts, steam table and non-programmable calculate is permitted.
               iii) Figures to the right hand margin indicate full marks.
               iv) Assume suitable data if necessary.
               v) Q.No.5 and 10 are compulsory.

SECTION-A

Q.1   a) State the unit of refrigeration & prove that 1 ton = 3.517KW.   04
      b) Explain the difference between heat pump & refrigerator.   04
      c) A cold storage is to be maintained at-5^0 C. while the surroundings are at 35^{0}C. The heat leakage   08
          from the surroundings into the cold storage is estimated to be 29 KW. The actual cop of the
          refrigeration plant is one-third of an ideal plant working between the same temperatures. Find the
          power required to drive the plant.

Q.2   A vapour compression refrigeration machine, with R-12 as refrigerant, has a capacity of 20 tonne of   16
          refrigeration operating between -28^{0}C & 26^{0}C.the refrigerant is sub cooled by 4^{0}C before entering
          the expansion valve & the vapour is superheated by 5^{0}C before leaving the evaporator. The machine
          has a six –cylinder single acting compressor with stroke equal to 1.25 times the Bore. It has a
          clearance of 3% of the stroke volume determine:-
            i) Theoretical power required
            ii) CoP
            iii) Volumetric efficiency
            iv) Bose & stroke of the cylinder.
             The speed of the compressor is 1000rpm. Specific heat of liquid refrigerant = 0.963 KJ/kg k,
          Specific heat of superheated vapour = 0.016 KJ/kg k.

Q.3   A refrigeration installation using R-12 comprises. One compressor, one condenser and three   16
          evaporator of capacities 15TR, 25TR, & 30TR respectively. The temperature to be maintained in the
          evaporators is 5^{0}C, 0^{0}C& -5^{0}C respectively. Each evaporator is fitted with an individual expansion
          valve. The condenser pressure is to be maintained at 10 bars. The exit condition from the evaporator
          is to be dry saturated and the liquid is sub cooled by 5^{0}C in the condensers. Determine
            i) Refrigerating effect in each evaporator
            ii) Mass flow rate in each evaporator
            iii) Compressor power
            iv) COP of the system

Q.4 The following data refer to a boot strap air cycle evaporator refrigeration system used for an Aeroplane to take 20 tonnes of refrigeration load: 16

  1) Ambient air temp. 15^0C

  2) Ambient air pressure = 0.8 bar

  3) Mach number of flight = 1.2

  4) Ram Efficiency = 90%

  5) Pressure of air bled off the main compressor = 4 bar

  6) Pressure of air bled off the main compressor = 90%

  7) Isentropic efficiency of the secondary compressor = 80%

  8) Isentropic efficiency of the secondary compressor = 90%

  9) Isentropic efficiency of the cooling turbine = 80%

  10) Temperature of air leaving the first heat exchanger = 170^0C.

  11) Temperature of air leaving the second heat exchanger = 155^0C.

  12) Temperature of air leaving the evaporator = 100^0C.

  13) Cabin Tempt. = 25^0C.

  14) Cabin pressure = 1 bar.

  Find: - 1) Mass of air required to take the cabin load.

    2) Power required for the refrigeration system and,

    3) COP of system

Q.5 Write short notes on the following (<u>any three</u>)   18

  i) Bell Coleman cycle

  ii) Actual vapour compression cycle

  iii) Reduced Ambient air cooling system

  iv) DART

  v) VCC with superheating & sub cooling of refrigerant.

SECTION -B

Q.6 a) State the advantages of vapour absorpsorption refrigenation system over vapour compression refrigeration system.   08

  b) Explain the modified vapour absorption system with neat sketch.   08

Q.7 a) What are the essential proportions or requirement while selecting the refrigerants? Explain in detail.   08

  b) Why most of the currently popular halo carbons refrigerants are phased out?   08

Q.8 a) Define :-   06

  i) Specific Humidity

  ii) Dew point Temperature

  ii) Wet Bulb Temperature

  iv) Enthalpy of moist air

  v) Dry Bulb Temperature

  vi) Relative Humidity.

  b) For a DBT 30^0C and WBT of 18^0C. calculate the following for air, when barometric pressure was observed to be 756mm of Hg. (without making use of psychometric chart)   10

  i) Relative Humidity

  ii) Specific Humidity

  iii) Dew point Temperature

  iv) Enthalpy of air per kg of dry air.

  v) Volume of mixture per kg of dry air.

Q.9   An air conditional hall is to be maintained at 27^0C dry bulb temperature and 21^0C wet bulb   16
temperature. It has a sensible heat load of 46.5KW and latent heat load of 17.5KW. The air supplied
from outside atmosphere at 38^0C dry bulb temperature & 27^0C wet bulb temperature is 25 cubic
meters per minute directly into the room through ventilation and infiltration. Outside air to be
conditioned is passed through the cooling coil and 60% of the Saturn air mixes with conditioned air
after the cooling coil. Determine:-
  i) Condition of air after the coil & before the recalculated air mixed with it.
  ii) Condition of air entering the hall i.e. after mixing with recirculate air.
  iii) The quantity of fresh air entering the cooler.
  iv) By pass factor after cooling coil and
  v) Refrigeration load on the cooling coil. Apparatus dew point (ADP) cooling coil is 15^0C.

Q.10   Write short notes on following. (<u>any three</u>)   18
   i) ODP & GWP
   ii) Cold storage
   iii) Human comfort parameters and comport charts
   iv) Applications of refrigeration in feed processing.
   v) Year round air conditioning system.