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# AU/ME - 803
## B.E. VIII Semester
Examination, June 2016
### Refrigeration and Air Conditioning
#### Time : Three Hours
##### Maximum Marks : 70

*Note:*  i)  Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii)  All parts of each question are to be attempted at one place.

iii)  All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.

iv)  Except numericals, Derivation, Design and Drawing etc.

v)  Use of refrigeration chart / steam table is permitted.

1.  a)  List different ways of producing refrigeration.

b)  State merits and demerits of an air-refrigeration system.

c)  Explain with neat sketch working of vortex tube.

d)  Describe with a schematic diagram and draw the T-S representation of the processes of boot strap evaporation type aircraft refrigeration system.

OR

Describe with a line diagram and T-S diagram about regenerative air refrigeration system. Mention all the formulas used.

2.  a)  Discuss the effect of suction pressure and supercharging on the performance of vapour compression system.

b)  What is the function of flash inter cooler provided in a compound vapour compression refrigeration system.

c)  Explain two stage compression with intercooling and subcooling by external cooling source.

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5.  a)  What are the requirements of good room air distribution.

b)  List the variables which are involved in the estimation of load.

c)  Enumerate and explain the components of internal heat gains.

d)  The following data relate to a conference room for seating 80 persons.

Inside design conditions : 22°C DBT, 55% RH

Outside design conditions : 38° DBT, 28°C WBT

Sensible and latent heat loads per person : 75W and 45W respectively

Lights and fans loads : 12000 W.

Sensible heat gain through glass, walls, cooling etc. : 12000 W

Air filtration : 18 m³/min

Fresh air supply : 80 m³/min

By pass factors of the coils : 0.1

If two-third of recirculated air (room) and one third of fresh air are mixed before entering the cooling coils, Determine

i)  Apparatus dew point

ii)  Grand total heat load

iii) Effective room sensible heat factor

OR

An office for seating 30 occupants is to be maintained at 22°C DBT and 55% RH.

The outdoor conditions are 36°C DBT and 27°C WBT.

The various loads in the office are:

Solar heat gain : 8500 W

Sensible heat gain per occupant : 83 W

Latent heat gain per occupant : 100 W

Lighting load : 2500 W

Sensible heat load from other sources - 12000 W

Infiltration load - 15 m³/min

Assume 40% fresh air and 60% of recirculated air passing through the evaporator coil and by pass factor of 0.12.

Determine : i)  Dew point temperature of the coil.

ii)  Capacity of the plant.

d) In a 12 tonnes refrigeration ammonia plant compression is carried out in two stages with water and flash intercooling and water subcooling. Condenser pressure, evaporator pressure and flash intercooler pressures are 12 bar, 3 bar and 6 bar respectively. If the limiting temperature for intercooling and subcooling is 20°C. Determine the following:

i) Coefficient of performance of the plant.

ii) The power required for each compressor.

iii) The swept volume for each if the volumetric efficiency of each of the compressor is 82%.

OR

The following data refer to single stage vapour compression system.

Refrigerant used → R-134a

Condensing temperature → 35°C

Evaporator temperature → (−10°C)

For compressor (RPM) → 2800

Clearance volume / swept volume → 0.03

Swept volume = 269.4 cm³, expansion index = 1.12

Compression efficiency = 0.8

Condensate sub cooling = 5°C

Get (i) Tonnage capacity  (ii) Power  (iii) C.O.P. (iv) Heat rejected to condenser.

a) State the function of absorber and rectifier in vapour absorption system.

b) Give the comparision between vapour absorption and vapour compression system.

c) State the advantages and disadvantages of "Electrolux refrigerator" over conventional refrigerators.

d) Explain with neat sketch working of steam jet refrigeration system.

OR

State the properties and uses of the following refrigerants

i) Ammonia   ii) Carbon-dioxide   iii) R-12

4. a) Define by-pass factor in air-conditioning.

b) Define degree of saturation and Relative humidity in air-conditioning.

c) Prove that specific humidity (w)

$$(w) = \frac{0.622\, p_v}{p_t - p_v}$$

Where, $p_v$ = Partial pressure of water vapour

$p_t$ = Total pressure of atmospheric air

d) The following data is related with air-conditioning load of a room.

Outside conditions → 36°C DBT, 27°C WBT

Inside conditions → 24°C DBT, 50% RH

Sensible heat load → 12 kW

Latent heat load → 7.3 kW

Apparatus dew point → 7°C

By pass factor of cooling coil → 0.1

Return air from the room is mixed with the outside air before entering the cooling coil in the ratio of 4:1 and return air from room is also mixed after the cooling coil in the ratio of 1:4. The air may be reheated, if necessary before supplying to the conditioned room.

OR

An air-conditioned auditorium is to be maintained at 27°C DBT and 55% RH. The ambient condition is 39°C DBT and 28°C WBT. The total sensible heat load is 120000 kJ/hr. and the total latent heat load is 45000 kJ/hr. 60% of the return air is recirculated and mixed with 40% of make-up after the cooling coil. The condition of air leaving the coil is 17°C. Determine

i) Room sensible heat factor

ii) Condition of air entering the auditorium

iii) Amount of make up air

iv) Apparatus dew point

v) By pass factor of cooling coil