

Roll No

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.

- List different ways of producing refrigeration.
 - State merits and demerits of an air-refrigeration system.
 - Explain with neat sketch working of vortex tube.
 - Describe with a schematic diagram and draw the T-S representation of the processes of bootstrap 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.

- Discuss the effect of suction pressure and supercharging on the performance of vapour compression system.
 - What is the function of flash inter cooler provided in a compound vapour compression refrigeration system.
 - Explain two stage compression with intercooling and subcooling by external cooling source.

- What are the requirements of good room air distribution.
 - List the variables which are involved in the estimation of load.
 - Enumerate and explain the components of internal heat gains.
 - 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/minFresh 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

- Apparatus dew point
- Grand total heat load
- 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:
- Coefficient of performance of the plant.
 - The power required for each compressor.
 - 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.

3. a) State the function of absorber and rectifier in vapour absorption system.
- b) Give the comparison 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

- Room sensible heat factor
- Condition of air entering the auditorium
- Amount of make up air
- Apparatus dew point
- By pass factor of cooling coil