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**Reg. No. :**

**Question Paper Code: 4907B**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Elective

Mechanical Engineering

14UME913 - REFRIGERATION AND AIR CONDITIONING

(Approved Refrigeration table and Steam table are allowed)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. Reversed Carnot cycle assumes that all the process in the cycle are

(a) Non- flow only (b) Steady flow only

(c) Non- flow or steady flow (d) Transient flow

2. A domestic refrigerator capacity may be approximately

(a) 1 ton (b) 0.1 ton (c) 1.5 ton (d) 10 ton

3. High boiling point refrigerants are preferably suited for

(a) Reciprocating air compressors (b) centrifugal compressors

(c) Small screw type compressors (d) For all the above.

4. The refrigerant R-764 stands for

(a) Ammonia (b) carbon dioxide (c) Sulphur dioxide (d) Methyl Chloride

5. During sensible cooling, wet bulb temperature

(a)Decreases (b)Increases (c) Remains constant (d) Can decreases or increases

6. The heat production from a normal healthy man when sleep is about

(a) 20 Watts (b) 40 Watts (c) 60 Watts (d) 80 Watts

7. For winter air conditioning, the relative humidity should not be more than

(a) 40 % (b)60 % (c)75 % (d) 90 %

8. The sensible heat factor for auditorium or cinema hall is generally kept as

(a) 0.6 (b) 0.7 (c) 0.8 (d) 0.9

9. The refrigerant commonly used in vapour absorbtion system is

(a) Ammonia (b) Freon (c) Aqua - ammonia (d) Sulphur dioxide

10. The velocity of steam at the nozzle exit is

(a) subsonic (b) sonic (c) Supersonic (d) any of these

PART - B (5 x 2 = 10 Marks)

11. List merits and demerits of air refrigeration system.

12. The evaporator pressure kept above atmospheric in most of the refrigeration systems –

Justify.

13. Define Dalton’s law.

14. Define an ‘air- conditioning system’. Name its basic elements.

15. State food preservation.

PART - C (5 x 16 = 80 Marks)

16. (a) A refrigerating plant works between temperature limits of -5 ̊C and 25 ̊C. The working

fluid ammonia has a dryness fraction of 0.62 at entry to compressor. If the machine has

a relative efficiency of 55%, calculate the amount of ice formed during a period of

24 hours. The ice is to be formed at 0 ̊C from water at 15 ̊C and 6.4 kg of ammonia is

circulated per minute. Specific heat of water is 4.187kJ/kg and latent heat of ice is

335 kJkg. (16)

Properties of NH3 (datum -40 ̊C)

|  |  |  |  |
| --- | --- | --- | --- |
| Temperature  ( ̊C) | Liquid Heat  (kJ/kg) | Latent Heat  (kJ/kg) | Entropy of Liquid  (kJ/kg) |
| 25 | 298.9 | 1167.1 | 1.124 |
| -5 | 158.2 | 1280.8 | 0.630 |

Or

(b) Explain the construction and working principle of simple vapour compression system

with neat sketch and state its merits and Demerits. (16)

17. (a) (i) Explain different types of rotary compressors with neat sketch. (10)

(ii) Discuss the comparison between water-cooled and air-cooled condensers. (6)

Or

(b) Discuss the different types of evaporators with neat sketch. (16)

18. (a) The sling psychrometer in a laboratory test recorded the following readings:

Dry bulb temperature = 35̊C : wet bulb temperature = 25̊C ,

Calculate the following :

(i) Specific humidity ; (ii) Relative humidity , (iii) vapour density in air :

(iv) Dew Point temperature: (v) Enthalpy of mixture per kg of dry air.

Take atmospheric pressure = 1.0132 bar. (16)

Or

(b) Explain the following terms by using Psychrometric chart (16)

(i) Heating with Humidification and

(ii) Cooling with Dehumidification.

19. (a) 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

120000kJ/h and the total latent heat load is 45000kJ/h. 60 percent of the return air is

recirculated and mixed with 40 percent of make-up air after the cooling coil. The

condition of air leaving the coil is 17 ̊C. determine (16)

(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 the cooling coil,

Or

(b) Air flowing at the rate of 100m3/min at 40 ̊C DBT and 50% RH is mixed with another

stream flowing at the rate of 20 m3/min at 26 ̊C DBT and 50% RH. The mixture of flows

over a cooling coil whose ADP temperature is 10 ̊C and by-pass factor is 0.2. Find DBT

and RH of air leaving the coil. If this air is supplied to an air-conditioned room where

DBT of 26 ̊C and RH of 50% are maintained, estimate room sensible heat factor and

cooling load capacity of the coil in tones of refrigeration. (16)

20. (a) (i) Explain the construction and working principle of Domestic Electrolux Refrigerator

with neat sketch. (8)

(ii) In an absorbtion type refrigeratior, the heat is supplied to NH3 generator by

condensing system at 2 bar and 88 percent dry. The temperature in the refrigerator is

to be maintained at -4̊C. Find the maximum C.O.P possible.If the refrigeration load is

18 tonnes and actual C.O.P is 72 percent of the maximum C.O.P., Find mass of steam

required per hour. Take the temperature of the atmosphere as 25̊C. (8)

Or

(b) Describe with a neat sketch the construction and working of storage type water cooler.

(16)