

KATHMANDU UNIVERSITY  
End Semester Examination  
March/April, 2017

Marks Scored:

Level : B. E.

Year : IV

Exam Roll No. :

Time: 30 mins

Course : MEPP 403

Semester : I

F. M. : 20

Registration No.:

Date : APR 10 2017

SECTION "A"

[10 Q × 1 = 10 marks]

Mark [√] for the most appropriate answer (s).

1. A ton of refrigeration is equivalent to  
 50 kcal/sec       210 kJ/min       4 Kw       60 kcal/min
2. Room sensible heat factor is the ratio of  
  $\frac{RSH}{RSH+RLH}$         $\frac{RLH}{RSH+RLH}$         $\frac{RSH}{RLH}$         $\frac{RLH}{RSH}$
3. The designation of refrigerants with chemical formula  $C_2Cl_3F_3$  is  
 R 12       R 22       R 113       R 133
4. During the heating and dehumidification process the enthalpy of air  
 decreases       increases  
 remains constant       may increase, decrease or remain constant
5. Air refrigeration works on the principle of  
 Carnot cycle       Rankine cycle  
 Bell-Coleman cycle       Brayton cycle
6. Wet compression cycle for a vapor compression refrigeration means  
 the entire compression of the vapor should be in superheated region  
 the entire compression of the vapor should be in wet region  
 the entire compression should be in sub-cooled region  
 the vapor enters the compressor in dry state but leaves the compressor in wet state
7. In ammonia - water absorption refrigeration system  
 ammonia is used as a refrigerant and water as an absorbent  
 water is used as a refrigerant and ammonia as an absorbent  
 ammonia is used as an absorbent and lithium bromide as refrigerant  
 lithium bromide is used as a refrigerant and ammonia as an absorbent
8. In winter air-conditioning system for cold and humid outdoor conditions, the required comfort conditions are obtained by employing  
 Cooling with humidification       Heating with dehumidification  
 Cooling with dehumidification       Heating with humidification

9. Consider a Heat pump or a direct electrical heater is used to heat the same room. For the same heating effect the later arrangement uses  
 more electrical energy than the former     less electrical energy than the former  
 Same electrical energy as the former     cannot be predicted
10. For northern hemisphere providing fenestration on  
 northern side of the building is beneficial for winter heating  
 southern side of the building is beneficial for winter heating  
 any direction does not have any effect on winter heating  
 any direction have same effect on winter heating

SECTION "B"

[10 Q. × 1 = 10 marks]

11. The sensible heat factor for sensible heating is \_\_\_\_\_.
12. When flash gas removal is used in a multistage compression, it \_\_\_\_\_ the work to be done in high pressure compressor.
13. In vapor compression refrigeration system, wet compression \_\_\_\_\_ the COP of the cycle.
14. The vapor absorption cycle is described as a \_\_\_\_\_ operated cycle.
15. A system with multiple evaporators at different temperatures with compound compression will \_\_\_\_\_ power requirements.
16. The relative humidity \_\_\_\_\_ during cooling and humidification process.
17. The by-pass factor (BF) for the process is defined as the ration of the difference between the mean surface temperature of the coil and leaving air temperature to the difference between the mean surface and the \_\_\_\_\_ air temperature.
18. Multi \_\_\_\_\_ systems are widely used when refrigeration is required at different temperatures.
19. A single zone, \_\_\_\_\_, constant volume system can be used either for cooling or for heating, but not for both cooling and heating simultaneously.
20. Ventilation requirement depends on \_\_\_\_\_ and also on activity level.

KATHMANDU UNIVERSITY  
End Semester Examination  
March/April, 2017

APR 10 2017

Level : B. E.  
Year : IV  
Time : 2 hrs. 30 mins.

Course : MEPP 403  
Semester : I  
F. M. : 55

SECTION "C"

Attempt *ALL* questions. Assume suitable data if any is missing.

1. a. Compare vapor compression refrigeration system with an absorption refrigeration system with the help of schematic diagram. Explain briefly each of the major components used in these both refrigeration systems. [7]  
b. 6 grams of water vapor per kilogram of atmospheric air is removed and temperature of air after removing the water vapor becomes 20 °C DBT, find i) Relative humidity ii) Dew point temperature iii) Wet bulb temperature. Assume condition of atmospheric air is 30 °C, 1 atm pressure and 50% RH. (Read values from psychometric chart). [4]
2. a. What are the different categories of loads to be considered for heating and cooling load calculation of an air-conditioning system? How heating and cooling energy demand of the buildings and heating and cooling load differ each other? [3]  
b. A classroom is to be air conditioned for 40 students when the outdoor conditions are 12°C DBT and 80% RH. The required conditions of the room are 20 °C and 60% RH. If the quantity of air supplied is 0.3 m<sup>3</sup>/min/person, find the following: [8]
  - i. Heating capacity of the coil in kW,
  - ii. The surface temperature required if the bypass factor of the heating coil is 0.4, and
  - iii. The capacity of the humidifierThe required condition is achieved first by heating and then by adiabatic humidification. (Show the process in Psychometric chart and leave the chart along with your answer copy).
3. a. The owner of the dairy industry needs to store milk and ice-cream at two different storage temperatures. He has been doing it with two different refrigerators one with very low temperature for ice-cream and the other with moderate temperature for milk storage. As a student of refrigeration and air-conditioning, can you advise him to use a single refrigerator to serve his purpose? If you can, explain him how your refrigerator work with the help of schematic and T-S diagram. [6]  
b. An aircraft refrigeration plant has to handle a cabin load of 25 tonnes. The atmospheric temperature is 16 °C, the atmospheric air is compressed to a pressure 0.96 bar and temperature of 29 °C due to ram effect. This air is then further compressed in a compressor to 4.8 bar, cooled in a heat exchanger to 66 °C, expanded in a turbine to 1 bar pressure and supplied to the cabin. The air leaves the cabin at a temperature of 26 °C. Calculate mass of air circulated per min and COP of the cycle. (Draw Schematic and TS diagram, take  $C_p = 1.005 \text{ KJ/kg.k}$ ,  $C_p/C_v = 1.4$ ). [5]

4. a. What is thermal distribution system in air conditioning system? Describe single duct, single zone, constant volume air conditioning system with the help of schematic diagram. [5]
- b. An ideal vapor compression refrigeration cycle operates between an evaporator temperature of  $-10\text{ }^{\circ}\text{C}$  and at a condenser temperature of  $40\text{ }^{\circ}\text{C}$ . The mass flow rate of the refrigerant R12 in the cycle is  $1\text{ kg/min}$ . Determine i) the COP of the cycle and ii) the refrigerating capacity and the compressor power. [6]
5. a. What are the refrigerants? Describe the desirable properties of refrigerants. [4]
- b. Name different air-conditioning processes. Explain how each of these process could be achieved in air-conditioning system. [4]
- c. With the help of T-S diagram, show how reversed Carnot cycle has larger refrigerating effect and smaller compression work than the ideal vapor compression refrigeration cycle. [3]