Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: ME405
Course Name: REFRIGERATION AND AIR CONDITIONING

Max. Marks: 100   Duration: 3 Hours

Use of Refrigeration and Air Conditioning data book is permitted

PART A
Answer any three full questions, each carries 10 marks.

Marks

1 a) What you mean by natural refrigeration and artificial refrigeration? Give two examples each. (5)

   b) With the support of schematic flow diagram and T-S diagram, explain the working of simple bootstrap aircraft refrigeration system (5)

2 a) A refrigeration system produces ice at the rate of 30 kg/ hour at -2 ^{o}C from water at 25 ^{o}C. Determine the refrigeration effect and tonnage of the system. Also, find the COP, if the power input is 1.1 kW. (5)

   b) A refrigeration system working on Bell-Coleman cycle operates with a pressure ratio of 8 and lower pressure of 1 bar. The cold chamber exit temperature is 9.1^{o}C and expander inlet temperature is 29°C. If the expansion and compression follow polytropic process with n = 1.35, determine the COP. (5)

3 a) What is the principle of adiabatic demagnetization refrigeration? Describe its working using a schematic diagram. (5)

   b) In an ammonia vapour compression refrigeration system, the pressure in the evaporator is 2.1 bar and the ammonia at the evaporator entry is 0.19 dry and at the exit is 0.86 dry. During compression, the work input per kg of refrigerant is 150 kJ. Calculate the COP and theoretical piston displacement of the compressor, if the mass flow rate of refrigerant is 4.5 kg/min. (5)

4 a) With the support of p-h diagram, explain the influence of superheating of suction vapour and sub-cooling of condenser outlet on the COP of vapour compression refrigeration system. (5)

   b) Determine the theoretical COP of a vapour compression refrigerator with carbon dioxide as refrigerant, working between temperature limits of 25°C and -5°C. The dryness fraction of carbon dioxide at the compressor suction is 0.6. (5)

PART B
Answer any three full questions, each carries 10 marks.

5   a)   With the support of a schematic and p-h diagram, explain the working of a two stage vapour compression system with flash gas removal and inter-cooling.   (5)

    b)   Explain the desirable properties of refrigerants for vapour compression refrigeration systems.   (5)

6   a)   Explain with the help of schematic and p-h diagrams, the working of a two stage evaporator vapour compression refrigeration system with single compressor.   (5)

    b)   With the support of a schematic diagram, explain the principle of working of Electrolux refrigeration.   (5)

7   a)   State any five applications of refrigeration. With the support of a neat sketch, explain any one of the stated applications.   (5)

    b)   With a neat sketch explain any one type of water cooled condensers used in vapour compression refrigeration systems.   (5)

8   a)   With a neat sketch, explain the working of a flooded evaporator.   (5)

    b)   Describe the principle and working of thermostatic expansion valve.   (5)

PART C
Answer any four full questions, each carries 10 marks.

9   a)   Define the terms (i) dry bulb temperature, (ii) absolute humidity (iii) wet bulb temperature (iv) dew point temperature and (v) relative humidity   (5)

    b)   Determine the dew point temperature, absolute humidity, specific enthalpy and specific volume of moist atmospheric air at mean sea level, if the dry bulb and wet bulb temperatures are 28^oC and 21^oC, respectively. Show these properties using a representative psychrometric chart.   (5)

10   a)   100 m^3/min of air at 20% relative humidity and 5^oC is to be conditioned to 50% relative humidity and 30^oC. Determine the load on the air conditioning unit. Also, determine the amount of water to be added or removed from the air during the process.   (5)

    b)   What you mean by effective temperature in air conditioning? Describe a comfort chart.   (5)

11   In an air conditioning plant, the air handling unit supplies 4500 m^3/min of dry air which include 20% (by weight) fresh air at 40^oC DBT and 27^oC WBT. The re-circulated air is at 25^oC and 50% relative humidity. The air leaves the cooling   (10)

coil at 13°C in saturates state. Calculate the total air conditioning load and room heat gain.

12 a) Draw the schematic diagram of window air conditioner; describe its working. (5)

     b) With a schematic diagram, explain the construction and working of an year round air conditioning system (5)

13 a) Compare and contrast between the split system and packaged system in room air conditioning. (5)

     b) Explain any one method of duct design and its applicability (5)

14 a) What are the special considerations to be made when designing an air conditioning system for hospitals. Give schematic illustrations to support your points. (5)

     b) Explain any one type of humidifiers used in air conditioning systems with illustrations. (5)

****