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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4097 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION 2010-11

REFRIGERATION AND AIR CONDITIONING

Time : 3 Hours *Total Marks : 100*

Note : (1) Attempt **all** questions.

(2) All questions carry equal marks.

(3) Be precise in your answer.

(4) Use of steam tables, refrigerant's property tables and psychrometric charts, T-c and h-c chart for aqua-ammonia is allowed.

(5) Assume missing data suitably, if any.

1. Attempt any **four** parts of the following : **(5×4=20)**

(a) Discuss various sources of heat to justify the use of a refrigeration system for an air craft ?

(b) Describe the operation of Joule Air Refrigeration cycle with the help of its block diagram, P-v and T-s diagram.

(c) Explain the working of Reduced Ambient Air Craft Refrigeration system with the help of its schematic diagram and T-s diagram.

(d) Define unit of refrigeration. List various methods of refrigeration.

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(e) Derive an expression for the COP of Cannot Refrigeration Cycle. A scientist claims to have develop a refrigerator which maintains a freezer temperature of –15 °C in a room whose temperature is 35 °C and have a COP of 6.5. Justify, whether his claim is true or false.

(f) Define DART (Dry air rated temperature). How it varies with the speed of Aircraft for common Aircraft Refrigeration Systems (Show the plots for the variation) ?

2. Attempt any **two** parts of the following : **(10×2=20)**

(a) Answer the following :

(i) Discuss the effect of superheating of suction vapour and subcooling of liquid on the various parameters of vapour compressor refrigeration.

(ii) Compare vapour compression refrigeration system with air refrigeration system.

(b) The pressure in the evaporator of a refrigerator is 1.9 bar, the pressure in the condenser is 12.4 bar. Dry saturated vapour delivered to the condenser after isentropic compression, and no under cooling of the condensed liquid. Calculate the refrigeration effect per unit mass of the refrigerant and the COP.
Use the following properties for the refrigerant :

At 1.9 bar, $T_{sat} = -20°C$

$S_g = 5.623$ kJ/kg K, $h_g = 1420.0$ kJ/kg, $h_f = 89.8$ kJ/kg

At 12.4 bar, Tsat = 32°C

$S_g = 4.962$ kJ/kg K, $h_g = 1469.9$ kJ/kg, $h_f = 332.8$ kJ/kg

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(c) What do you understand by removed of flash gas ? With the help of schematic diagram explain the function of a flash chamber/ flash intercooler in a multistage compression system.

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) Explain the working of Li-Br water absorption refrigeration system with the help of neat sketch. Compare vapour absorption system with vapour compression refrigeration system.

(b) Answer the following :

(i) Explain the method of obtaining an isotherm (in two phase region) on enthalpy concentration (h-c) diagram for a binary mixture.

(ii) Explain the significance of Analyzer, Rectifier and Aqua Heat Exchanger used in aqua ammonia vapour absorption refrigeration system.

(c) Define secondary refrigerant and enlist various properties of primary refrigerants. Give the refrigerant number for the following : CCl_2F_2, CH_4, Air, $CH_2F–CF_3$

4. Attempt any **two** parts of the following: **(10×2=20)**

(a) Explain "Adiabatic Saturation" and "Thermodynamic Wet Bulb Temperature". Discuss the working of a Psychrometer.

(b) Why psychrometric chart is most commonly used in solving the problems of air conditioning ? Explain different psychrometric processes commonly used in air conditioning, after showing them on psychrometric chart (plot on your answer book).

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(c) Atmospheric air at a pressure of 750 mm of mercury is at a dry bulb temperature of 35 °C and wet bulb temperature of 23 °C. Using Carrier equation for determining the partial pressure of vapour and steam table determine : (i) relative humidity, (ii) humidity ratio, (iii) dew point temperature, (iv) density and (v) enthalpy of air.

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) What are the different types of expansion devices used in refrigeration and air conditioning units ? Describe any two in brief.

(b) What is Food Preservation ? Describe a cold storage and highlight the factors to be considered in the design of a cold storage.

(c) With the help of neat sketch, explain the working of "Refrigerator" and "Water Cooler".

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