BITS, Pilani –Dubai

Dubai International Academic City, Dubai, U.A.E

IV Year II Semester 2009-2010

COMPREHENSIVE EXAMINATION   [CLOSED BOOK]

Course No. CHE C471 / ME C461   **Course Title:** REFRIGERATION & A/C

Max.Marks: 80   **Weightage:** 40%

Date: 20-05-2010   **Duration:** 3HRS

Notes:
- Answer all the questions
- Draw neat sketches wherever necessary
- Make suitable assumptions if required and clearly state them
- *Refrigeration / Psychometric charts and Tables* are permitted

1a) Compare the different air Refrigeration systems used in Air craft :-   **[4M]**

b) Analyze the Boot - Strap air refrigeration systems   **[4M]**

c) Air craft is flying at an altitude of 8000 m at a speed of 900 km/hr. The pressure and temperature of air at this altitude are 0.34 bar and 263 k respectively. The air is compressed by an air compressor with a compression ratio of 5. The cabin pressure is 1.013 bar and the temperature is 300 K. Determine the power required for pressurization excluding ram work. Extra power required for refrigeration purpose and refrigeration capacity of the system if the air flow rate is 1 kg/s.

Take the following data.

$\acute{\eta}_c$ = 82 %, $\acute{\eta}_e$ =77% Effectiveness of HE = 0.8 , Ram efficiency = 84 %   **[9M]**

2a) Explain Cascading in Multi Pressure Refrigeration systems.   **[4M]**

b)   A simple refrigerant cycle using R12 is designed for taking a load of 10 tons. The refrigerator and ambient temperatures are -0°C and 30°C respectively. A minimum temperature difference of 5°C is required in evaporator and condenser for heart transfer. Find**(i)** Mass flow rate trough the system **(ii)** Power required in kW.**(iii)** cylinder dimensions assuming L/D =1.2 for a single acting cylinder, single acting compressor if it runs at 300 R.P.M with volumetric effiencey = 0.9

        [9M]

3a) Analyze   Vapour Absorption refrigeration system   **[4M]**

b) Find the chemical formula for F114   **[3M]**

c) Explain ODP & GWP   **[4M]**

4a) Explain with diagram the **Summer** *Air conditioning*   **[5M]**

  b) Explain *Comfort Chart*   **[4M]**

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5. An Air-Conditioning system is to be designed for a Departmental Store when the following data is available:-

Transmission gain through Doors, Glass, Roof & Floor = 10000 kJ/hr

Solar transmission through Walls, Roof & Floor = 15000 kJ/hr

Solar Heat gain through glass = 6000 kJ/hr.

Equipment sensible heat gain = 9500 kJ/hr

Equipment Latent heat gain = 2000 kJ/hr

Infiltrated air flow = 500 m³/hr

The employees working = 15

Average customers in the Store = 25

Sensible heat gain per items in the store   : 200 kJ/ h

 Latent heat gain per items   : 250 kJ/ h

Outside Design conditions: 36^0C DBT and 25^0C WBT

Inside design conditions   : 25^0C and 54% RH

By pass factor of the coil is 0.15

Find the **Room Sensible & Latent heat load** and **total load** in the Departmental Store   **[18M]**

6. An air duct system is provided as shown in Fig below. Determine the dimensions of AB, BC, CD and the total pressure at fan outlet using **equal friction method**. Choose a friction rate of 0.08 mm water /m length of duct. Assume free exit at each out let.

      Losses   For elbow   : 0.25 Pv_2,

                     For branch : 0.2 Pv_2 + Elbow loss .

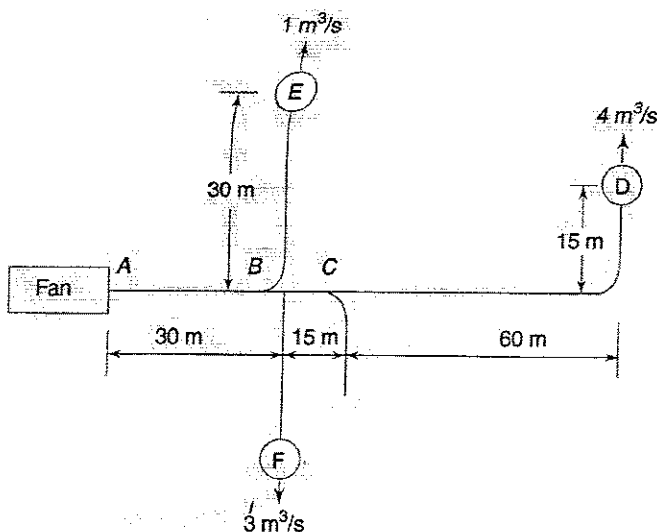   For straight-through section : 0.25 x difference of velocity pressures.

Fig Duct Layout

[12M]

TABLE 16.2   VENTILATION AIR REQUIREMENT

Application	Smoking Status	Recommended cmm/Person	Minimum	
			cmm/ person	cmm/m floor area
Apartments	Some	0.56	0.28	—
Offices and factories	Occasional-Som	0.28–0.6	0.21	—
Restaurants	Some	0.4	—	—
Board rooms	Very heavy	1.4	0.56	0.03
Department stores	None	0.21	0.14	0.0015
Theatres	None	0.21	0.14	—
Hotel rooms	Heavy	0.84	0.7	—
Hospital wards	None	0.84	—	—
Hospital operation theatres	None	All outdoor	—	—

Table 19.1   Heat Liberated due to Occupancy

Activity	Metabolic Rate W	Heat Liberated, W Room Dry Bulb Temperature, °C							
		20		22		24		26	
		S	L	S	L	S	L	S	L
Seated at rest	115	90	25	80	35	75	40	65	50
Office work	140	100	40	90	50	80	60	70	70
Standing	150	105	45	95	55	82	68	72	78
Eating in restaurant	160	110	50	100	60	85	75	75	85
Light work in factory	235	130	105	115	120	100	135	80	155
Dancing	265	140	125	125	140	105	160	90	175

$$\frac{\Delta p_f}{L} = \frac{0.002268\ \dot{Q}_v^{1.852}}{D^{4.973}}$$

$$\Delta p = 0.00047\ (C)^2$$

$$p_{V_A} = \left(\frac{C}{4.04}\right)^2$$

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Course No. CHE C471 / ME C461   **Course Title:** REFRIGERATION & A/C

Date: 11-04-2010   **Max.Marks:** 20   **Weightage:** 20%   **Duration:** 50 min.

Notes:
- Answer all the questions
- Draw neat sketches wherever necessary
- Make suitable assumptions if required and clearly state them
- Refrigeration charts and Tables& Psychometric charts are permitted

Q.1. In an Absorption Refrigeration system, heating, cooling and refrigeration take place at the temperatures of 120^0C, 30^0C and -10^0C. Find the following:

(a) Ideal C.O.P of the system

(b) If the heating temperature is increased to 160^0C and refrigerant temperature is decreased to -20^0C, Find the percentage change in ideal C.O.P

(c) If the heating is carried out in both cases the steam and assuming actual C.O.P is 70% of ideal C.O.P, find the quantity of steam required per hour in both cases for 50 tons load system.

[6M]

Q 2.A. Which refrigerants are used for the following systems and mention the name of refrigerant used in each system

(a) House hold Refrigerator **(b)** Ice- making plant **(c)** Air conditioning plant for picture house.

(d) Meat packing plant **(e)** Research lab to test the properties of metals at -50^0C.

Justify your answer. **[5M]**

Q.2.B. What factors are considered in selecting a refrigerant in the following systems and mention the name of refrigerant

(a) Hotel air conditioning **(b)** Ship refrigeration (c) For Aero plane refrigeration **[5M]**

Q.3. Explain the working of Automatic expansion valve. Will it work satisfactorily under changing load conditions? **[4M]**

BEST OF LUCK

Course No. CHE C471 /ME C461   **Course Title:** REFRIGERATION & A/C

Date: 28-02-2010   **Max.Marks:** 25   **Weightage:** 25%   **Duration:** 50 min.

Notes:
- Answer all the questions
- Draw neat sketches wherever necessary
- Make suitable assumptions if required and clearly state them
- Refrigeration charts and Tables are permitted

Q 1 A. Enumerate the Standard Rating of a Refrigeration :   **[3M]**

     B. Explain Reversed Carnot cycle for Refrigeration   **[3M]**

Q 2.A. Explain Reduced Ambient Type Air Refrigeration System   **[3M]**

     B. In Bell Coleman cycle, environment temperature is 320 K and refrigeration temperature is 120 K. The minimum temperature of the cycle is 80K. The pressure in the refrigerator is 1 bar. Find the following:

(i) Maximum pressure and temperature of the cycle:

(ii) Refrigeration effect and heat rejected per kg of air.

(iii) Net work required per kg of air.

(iv) Compressor and expander swept volume per kg of air.

(v) COP of the cycle   **[6M]**

Q.3.A. Explain actual Bell -Coleman cycle   **[3M]**

     B. A Boot strap system is used for an Airplane. The pressure in the cabin is maintained at 1.013 bar and the air enters the cabin at 4.5^0C. The temperature of air used for cooling in the heat exchangers is 32^0C. The compressed air leaves the primary heat exchanger at 64^0C. Taking the following data as $\eta_{turbine}$= 85% $\eta_{secondary\ compressor}$ = 77% Find **(a)** the temperature of air entering the cooling turbine and **(b)** the pressure of air at discharge from primary and secondary compressors.   **[7M]**

BEST OF LUCK

BITS, PILANI – DUBAI

SECOND SEMESTER 2009 – 2010

QUIZ-2

Course Code: ME C461 / CHE C471   **FINAL YEAR**   Date: 28-04-2010

Course Title: **REFRIGERATION & A/C**   Max Marks: 14

Duration: 20 minutes   Weightage: 7%

Name: . . . . ID No: . . . . Prog: . . . .

1. 100 CMM of air at 30^0C DBT and 60% RH is cooled to 20^0C DBT by passing through a cooling coil   Calculate

   a)   Capacity of cooling coil in TR

   b)   RH of coming out air

   c)   WBT   of coming out air   (1.5 Marks each)

2. Explain *MATHEMATICAL MODEL OF HEAT EXCHANGE BETWEEN MAN & ENVIORONMENT*

                                                                        (2 Marks)

3. Explain three categories of Industrial A/C with examples   (4.5 Marks)

4. Explain **WINTER AIR CONDITIONING SYSTEMS**: -   (3 Marks)

Course Code: ME C461 / CHE C471

$QUIZ-1$

Date: 18-03.10

Course Title: REFRIGERATION & A/C

Max Marks: 16

Duration: 20 minutes

Weightage: 8%

Name: .... ID No: .... Sec / Prog: ....

Instructions: 1. Attempt all questions

1. Explain the necessity of cooling the Aero plane   (3 Marks)

2. Represent   Bel-Coleman cycle for Air refrigeration system on a   T-s & P-v   diagram
   (3Marks)

3. Explain the importance of **Flash chamber** in Vapour compression system   (3 Marks)

4. Explain Cascading   (3Marks)

5   Explain the effect of **liquid sub cooling** in a vapour compression refrigeration system   (2 Marks)

6. Explain the effect of super heated vapor in a vapour compression refrigeration system   (2 Marks)