Code No: RR410305 **Set No. 1**

IV B.Tech I Semester Regular Examinations, November 2006
REFRIGERATION & AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the boot strap air cycle refrigeration system with a schematic and cycle diagrams. [8]
   (b) Derive an expression for the COP of Bell- Coleman cycle. [8]
2. (a) Define the unit of refrigeration. [2]
   (b) A refrigerator using Ammonia works between the temperatures -10 deg. C and 25 deg. C. The gas is dry at the end of compression and there is no under cooling of liquid. Using the tables, Calculate the theoretical COP of the cycle. [14]
3. (a) Explain the working of a rotary screw compressor. [10]
   (b) How the capacity control is achieved in refrigerant compressor? [6]
4. (a) Explain the working of an evaporative condenser. [10]
   (b) Give the comparison of flooded evaporators and dry evaporators. [6]
5. (a) What are the characteristics of ideal absorbent and refrigerant mixture in vapour absorption refrigeration. [8]
   (b) Explain with a simple sketch the construction of Electrolux refrigeration system. [8]
6. In a Steam jet refrigeration system dry saturated steam at 7 bar abs. pressure is supplied. The flash chamber temperature is 5^oC, the condenser temperature is 40^oC, make up water is supplied at 20^oC. Assuming that quality of motive steam and flash vapour at the beginning of compression as 93% dry and efficiency of the nozzle, efficiency of entertainment and the efficiency of the thermo-compressor as $90\%, 65\% and 91\%$ respectively. Determine:
   (a) Weight of steam required per hour per ton of refrigeration.
   (b) The volume of vapour removed from the flash chamber per hour per ton of refrigeration. [16]
7. (a) Define the term "effective temperature" and explain its importance in air-conditioning systems. Describe the factors which affect the effective temperature. [8]
   (b) Define the "human comfort" and describe the factors which affect the human comfort. [8]

8. (a) Explain the working principle of a heat pump which makes use of Rankine power cycle with a neat diagram [8]
   (b) Explain solar energy assisted heat pumps by drawing the circuit. [8]

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Code No: RR410305 **Set No. 2**

IV B.Tech I Semester Regular Examinations, November 2006
REFRIGERATION & AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the difference between a refrigerator and a heat pump? [4]
   (b) The capacity of a refrigerator is 200 TR when working between - 8^oC and 26^oC. Determine the mass of ice produced per day from water at 26^0C. Also find the power required to drive the unit. Assume that the cycle operates on reversed carnot cycle and latent heat of ice is 335 kJ/kg. [12]

2. A simple vapour compression cycle using F-12 is designed to take a load of 10 tons. The refrigerator and ambient temperatures are 0^0C and 30^0C respectively. A minimum temperature of -5^0C is required in evaporator and condenser for heat transfer. Find
   (a) Mass flow rate through the system
   (b) Power required in kW
   (c) Cylinder dimensions assuming L/D ratio as 1.2 for a single cylinder and single acting compressor running at 300 RPM with a volumetric efficiency of 0.9 [16]

3. (a) Explain the working of a rotary screw compressor. [10]
   (b) How the capacity control is achieved in refrigerant compressor? [6]

4. (a) Differentiate between flooded type and dry expansion type evaporators. [6]
   (b) Explain the working of thermostatic expansion valve with the help of a neat sketch. [10]

5. (a) What are the characteristics of ideal absorbent and refrigerant mixture in vapour absorption refrigeration. [8]
   (b) Explain with a simple sketch the construction of Electrolux refrigeration system. [8]

6. (a) What are the limitations of steam jet refrigeration system. [8]
   (b) What are the merits of steam jet refrigeration system over other system? [8]

7. (a) A quantity of air having a volume of 300 m^3 at 30^oC (DBT) and 25^oC (WBT) is heated to 40^oC (DBT). Estimate the amount of heat added, final relative humidity and WBT. The air pressure is 1.01325 bar. [6]
   (b) $800m^3$ /min of re-circulated air at 22^oC (DBT) and 10^o dew point temperature is to mixed with 300 m^3/min of fresh air at 30^oC (DBT) and 50% RH. Determine the enthalpy, specific volume, humidity ratio and dew point temp of the resultant mixture. [10]

8. (a) With a simple sketch explain the principle of centrifugal dust collector. [6]
   (b) List the different methods of odour removal from air and write short notes on any three methods. [10]

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Code No: RR410305 **Set No. 3**

IV B.Tech I Semester Regular Examinations, November 2006
REFRIGERATION & AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the importance of Industrial Refrigeration citing specific cases. [4]
   (b) Distinguish between vapour absorption and vapour compression system and what is the distinct advantage of vapour absorption over vapour compression system. [4]
   (c) Explain the working principle of vapour compression refrigeration system with a neat diagram and also plot the same on a P-h and T-s diagram [8]

2. (a) Derive an expression for COP of vapour compression cycle from t-s chart when the refrigerant is dry saturated before compression. [6]
   (b) A vapour compression machine is used to maintain a temperature of -23^0 C in a refrigerated space. The ambient temperature is 37^o C. The compressor takes in dry saturated vapour of F- 12. A minimum 10^{0}c temperature difference is required at the evaporator as well as at condenser. There is no sub cooling of the liquid If the refrigerant flow rate is 1 kg/min, Find

   (i) tonnage of refrigeration

   (ii) power requirement

   (iii) Ratio of COP of this cycle to COP of carnot cycle. [10]

3. (a) Explain the working of a rotary screw compressor. [10]
   (b) How the capacity control is achieved in refrigerant compressor? [6]

4. (a) Explain the working of an evaporative condenser. [10]
   (b) Give the comparison of flooded evaporators and dry evaporators. [6]

5. The following efficiencies must be assumed
   Isentropic efficiency of turbine = 90%
   Steam jet refrigeration nozzle efficiency = 90%
   Entrainment efficiency = 65%
   Thermo compressor efficiency = 65%
   The steam enters the thermo compressor at 0.01 bar and with dryness fraction of 0.94, make up water enters the flash chamber at 18^0C
   determine (using Mollier diagram)

   (a) State of steam at all salient points

   (b) Quantity of steam leaving the flash chamber

(c) Quality of steam generated in the boiler

(d) COP of the steam jet refrigeration system based on the heat in put of the motive steam
Assume the same condenser for power turbine and steam jet refrigeration.

6. (a) How can you produce the cold with the vortex tube? [6]

(b) What is the principle in steam jet refrigeration. Explain with neat sketch.[10]

7. (a) An air water vapor mixture at 1 bar and 26.7^o C has a specific humidity of 0.0085. Determine the percentage saturation. [6]

(b) In a laboratory test a psychrometer recorded 36^{o}C DBT and 30^{o}C WBT calculate

(a) vapor pressure

(b) relative humidity

(c) specific humidity

(d) degree of saturation

(e) dew point temperature

(f) enthalpy of the mixture [10]

8. (a) A heat pump uses water at 10C as the source of heat and the air supplied to the room is to be at 35^{0}C. If the actual EPR attained is 70% of the reversed carnot cycle operating between the same temperatures, determine

i. The actual EPR of the heat pump system

ii. The power required to run the compressor if required heat load is 60,000 KJ/hr.

The power required to run the compressor if required heat load is 60,000 KJ/hr. [10]

(b) What are the different constructional features used in heat pump to improve the overall EPR? [6]

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Code No: RR410305 **Set No. 4**

IV B.Tech I Semester Regular Examinations, November 2006
REFRIGERATION & AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Give a brief description of an ideal cycle of air refrigeration. [6]
   (b) A carnot refrigerator and a heat pump are supplied with equal amount of work. The refrigerator operates between -27^{0}C and +27^{0}C and the heat pump operates between + 45^0 C and + 27^{0}C. The refrigerator absorbs 4000 kJ/ min at -27^{0}C. The heat pump absorbs all the heat rejected by the refrigerator and supplies at 45^{0}C. Compute

   (i) COP of refrigerator

   (ii) COP of heat pump

   (iii) heat available at + 45^{0}C and

   (iv) work input to each unit. [10]

2. (a) Describe the use of liquid vapour regenerative heat exchanger in a vapour compression system [6]
   (b) A simple saturation ammonia compression system has a high pressure of 1.35 MN/m^2 and low pressure of 0.19 MN/m^2. Find per 400,000kJ/h of refrigerating capacity the power consumption of the compressor and COP of the cycle. [10]

3. (a) Explain the working of a rotary screw compressor. [10]
   (b) How the capacity control is achieved in refrigerant compressor? [6]

4. (a) Explain the working of an evaporative condenser. [10]
   (b) Give the comparison of flooded evaporators and dry evaporators. [6]

5. (a) What is the effect of inert gas in three fluid refrigeration system. [4]
   (b) What is absorption refrigeration system and how it differs from convention vapour compression system and explain its working. [8]
   (c) What is Carnot COP of absorption refrigeration system. How it is differ from actual COP. [4]

6. (a) With the help of a sketch of the processes on Mollier chart explain how the refrigeration is produced in steam jet refrigeration system. [10]
   (b) What difference does it make when the steam jet refrigeration system operates with a barometric condenser instead of a surface condenser? [6]

7. An auditorium of 100 seating capacity of conditioned for the given specifications
   Out door conditions - 35 and 65% RH
   Required air inlet conditions - 15^o C and 40 RH.
   The required condition is achieved first by cooling and dehumidifying and then by heating. Find the following
   (a) The capacity of the cooling coil in tons of refrigeration
   (b) Capacity of the heating coil in kW
   (c) By-pass factor of the heating coil if the surface temp of the coil is 22^o C [16]
8. (a) Define the following in relation to the conditioned supply air to room 'Throw', 'Drop' and 'Spread'. [6]
   (b) State the different types of supply air out lots.
   (c) Describe the factors governing the selection and location of supply air outlets. [4]

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