

7E7012

Roll No.

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B.Tech. VII Semester (Main/Back) Examination, Nov./Dec. - 2015

Mechanical Engg.

7ME2A Refrigeration & Air Conditioning

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

Attempt any **five** questions, selecting one question from **each unit**. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

1. Refrigerant tables and charts 2. Psychrometric chart and steam table

Unit - I

1. a) Explain the effect of followings on the performance of vapour compression refrigeration system with the help of T-S & P-h charts.
- i) Decrease in evaporator pressure
 - ii) Increase in condenser pressure
 - iii) Suction vapour superheat
 - iv) Subcooling of saturated liquid
- b) Explain the construction and working of flash chamber incorporated in vapour compression system, How removal of flash gas helps in improving the performance of compound vapour compression refrigeration System? (8)

OR

1. a) Calculate cooling capacity in Tons, Indicated power and C.O.P of a simple NH_3 vapour compression system which has compressor with piston displacement of $2\text{m}^3/\text{min}$, a condenser pressure of 12 bar and evaporator pressure of 2.5 bar. The liquid is subcooled to 20°C by soldering the liquid line to suction line. The temperature of vapour leaving the compressor is 100°C , heat rejected to compressor cooling water is 5000 kJ/hour and volumetric efficiency of compressor is 0.8. (10)

- b) Explain with the help of neat sketch, the working of a refrigeration system having three evaporators at different temperatures with individual compressors and multiple expansion valves. (6)

Unit-II

2. a) A dense air refrigeration cycle operates between pressures of 4 bar and 16 bar. The air temperature after heat rejection to surroundings is 37°C and air temperature at exit of refrigerator is 7°C . The isentropic efficiencies of turbine and compressor are 0.85 and 0.80 respectively. Determine compressor and turbine work per TR, C.O.P. and power per TR, Take $\gamma = 1.4$ and $C_p = 1.005 \text{ KJ/Kg K}$. (10)
- b) Explain the term "tonne of refrigeration". What is the difference between a refrigerator and a heat pump? Derive an expression for the performance factor for both if they are running on reversed Carnot cycle. (6)

OR

2. a) The higher we go, the cooler we find, then why air crafts are air conditioned when they cruise at an altitude of 8000m? (6)
- b) An air craft moving with speed of 1000 km/h uses simple gas refrigeration cycle for air conditioning. The ambient pressure and temperature are 0.35 bar and -10°C respectively. The pressure ratio of compressor is 4.5. The Heat exchanger effectiveness is 0.95. The isentropic efficiencies of compressor and expander are 0.8 each. The cabin pressure and temperature are 1.06 bar and 25°C . Determine temperatures and pressures at all points of the cycle. Also find the volume flow rate through compressor inlet and expander outlet for 100 TR. Take $C_p = 1.005 \text{ KJ/Kg K}$, $R = 0.287 \text{ KJ/Kg K}$ and $C_p/C_v = 1.4$ for air. (10)

Unit - III

3. a) Describe the working of practical Aqua-Ammonia vapour absorption refrigeration system with neat sketch. (8)
- b) Explain with the help of neat sketch, the working of a steam jet refrigeration system (8)

OR

3. a) Explain the construction and working of thermostatic expansion valve. (8)
- b) Write the factors considered for the selection of refrigerant for a system. Give the chemical formula and names of the refrigerants R-22 and R-114. (8)

Unit-IV

4. a) Explain the following terms related to psychrometry:

- i) Specific humidity
- ii) Relative humidity
- iii) Degree of saturation
- iv) Dew point temperature,

Also explain the physical significance of each.

(8)

b) Atmospheric air at 0.965 bar enters the adiabatic saturator. The wet bulb temperature is 20°C and dry bulb temperature is 31°C during adiabatic saturation process. Determine:

- i) Humidity ratio of the entering air.
- ii) Vapour pressure and relative humidity at 31°C and
- iii) Dew point temperature.

(8)

OR

4. a) Define the term "Human Comfort" and explain the factors which affect human comfort.

(8)

b) Define the term "Effective temperature" and explain its importance in air conditioning system. Describe the factors which affect effective temperature.

(8)

Unit-V

5. A hall is to be maintained at 24°C DBT and 60% R.H. When the following data are given:

Outdoor conditions = 38°C DBT and 28°C WBT

Sensible heat load in the room = 1,60,000 kJ/hr.

Latent heat load in the room = 40,000 kJ/hr.

Total infiltrated air = 1200 m^3/hr

Apparatus dew point temp = 10°C

The quantity of recirculated air from the hall = 60% of total. If the recirculated air is mixed with the conditioned air after the cooling coil, then find the following

- i) The condition of air leaving the conditioner coil and before mixing with recirculated air.
- ii) Condition of air before entering the hall.
- iii) The mass of air entering the cooler.

- iv) The mass of total air passing through the hall.
- v) By pass factor of the cooling coil. (16)

OR

5. a) Differentiate between Central, District and Unitary air conditioning systems. (6)
- b) What do you understand by the term cooling load? What are the different factors considered in load estimation sheet for comfort application (10)

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