7E7012

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B. Tech. VII Sem. (Main / Back) Exam., Nov. – Dec. - 2018
Mechanical Engineering
7ME2A Refrigiration and Air-Conditioning

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 26

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. NIL _____ 2. NIL _____

UNIT- I

Q.1 (a) Discuss the actual vapour compression cycle with the help of P-h and T-S diagram. [8]

(b) A refrigerator's storage is supplied with 3700 kJ of a substance at a temperature of 27°C. A substance has to be cooled at -23°C. The cooling is about 10 hours. The specific heat of substance is 2 kJ/kg-K above freezing point and 0.5kJ/kg-K below freezing point. The freezing point of a substance is -3°C. The latent heat of freezing is 230 kJ/kg. What is the power required to drive the plant in kW if the actual COP is the half of ideal COP? [8]

OR

Q.1 (a) 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]

(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. [8]

UNIT- II

Q.2 (a) Air is used as refrigerants in a reversed Brayton cycle. Draw T-S and P-V diagram for this cycle and derive the expression for COP in terms of pressure ratio (γ_p). [8]

(b) A gas refrigeration system working on reversed Brayton cycle at a temperature of 250K at the inlet of the compressor. If the temperature at the end of constant pressure cooling is 300K and raising the temperature of air in refrigerator is 50K, then find the network out? (Take C_p = 1kJ/kg-K). [8]

OR

Q.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 Cp=1.005kJ/kg-K. [10]

(b) The higher we go, the cooler we find, then why aircrafts are air conditioned when they cruise at an altitude of 8000m? [6]

UNIT- III

Q.3 (a) Explain the construction and working of thermostatic expansion valve. [8]

(b) Draw a neat diagram of Electrolux refrigeration and explain its working principle. What is the important role of hydrogen in refrigeration systems? [8]

OR

Q.3 (a) Describe the working of practical Aqua- Ammonia vapour absorption refrigeration system with neat sketch. [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

Q.4 (a) What is thermal comfort? Explain the typical condition of thermal comfort with the help of bioclimatic chart. [8]

(b) Moist air at 1.013 bar and 30°C contains 10 gm. of water vapour per kg dry air. Assuming that air and water vapour mixture behaves as an ideal gas and the saturation pressure of vapour at 30°C is 3.167 kpcal. Find the relative humidity of air. [8]

OR

Q.4 (a) The humidity ratio of atmospheric air at 28°C DBT and 760mm of 1Hg is 0.016 kJ/kg of dry air. Determine- [8]

(i) Partial pressure of water vapour

(ii) Relative humidity

(iii) Dew point temperature

(iv) Specific enthalpy

(b) Define the term "Effective Temperature" and explain its importance in the design of air conditioning system. [8]

UNIT- V

Q.5 (a) What is heat load? Show the various steps of heat load calculation by taking a suitable example. [8]

(b) Write short notes on following- [8]

(i) Effect of bypass factor

(ii) Occupancy and Appliances load

OR

Q.5 (a) Explain the working of year round air conditioning system. [8]

(b) Explain the term cooling load. Explain the method of estimating heat gain due to Infiltration of air. [8]