Code No: 09A60303 R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: HYDERABAD

B. Tech III Year II Semester Examinations, May – 2013

Refrigeration and Air Conditioning

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

1.a) Describe by the aid of a diagram the principle of a refrigerating machine of an open cycle air type and obtain an expression for its effectiveness. Assume compression and expansion to be isentropic.

b) Air enters the compressor of a refrigerator system at a pressure of 1 bar and a temperature of -1°C where it is compressed isentropically to 4 bar by a compressor of 80% efficiency. The air is then cooled at constant pressure to a temperature of 15°C, after which it expands in a turbine to 1 bar with an expansion efficiency of 85%. The air then absorbs heat in a cold room and returns to the compressor. Determine the COP of the system. [15]

2. A food storage refrigeration system requires 12 tons capacity to maintain the food at – 8°C. The condenser temperature is 30°C. The vapour leaving the evaporator is Superheated by 5°C and liquid leaving the condenser is subcooled by 4°C. Find the following:

i) Theoretical COP

ii) theoretical power

iii) weight of refregerant circulated per minute

Assume the compressor is single acting and of two cylinders and is operating at 900 rpm and the stroke as 1.5 times of its bore. Also find the volumetric efficiency, bore and stroke if the clearance is 2%. [15]

3.a) Name three refrigerants that are suitable for ice plants giving their relative merits and demerits

b) Explain the terms:

i) Azeotrope ii) Hermetically sealed compressor. [15]

4.a) Derive the maximum possible COP of vapour absorption refrigeration system interms of condenser temperature, evaporator temperature and generator temperature.

b) Explain the function of liquid-vapour heat exchanger between the generator and absorber and how it can improve the performance of the vapour absorption system. [15]

5.a) Derive the expression for finding out the quantity of steam required per ton of refrigeration.

b) A steam jet refrigeration installation is to deliver chilled water at the rate of 2300 kg per minute at 8°C from supply water at 18°C. Condenser Saturation temperature is 38°C, nozzle efficiency is 90%, entrainment efficiency is 68% and diffuser efficiency is 78%. Quality of flashed vapour is 0.97. The steam consumption for the motive jet is 6500 kg/hr. Estimate the pressure of the dry and saturated motive steam. [15]

6.a) Write a short note on by-pass factor for cooling coils.

b) The sensible heat load factor (SHF) of an air-conditioned room is 0.67. The condition of the air leaving the air-conditioned room is 27°C DBT and 52% R.H. The maximum permissible temperature difference between the inlet air and out-let air is 11°C. If the quantity of air flow at the inlet of the room is 180 m^3/min, then find the sensible heat load and latent heat load of the air-conditioned room. [15]

7.a) Discuss the conditions of comfort you would prescribe for office building in a city, which has hot and humid climate.

b) An air-conditioned room is maintained at 27°C DB T and 52% R.H. The sensible heat load of the room is 27 kW, and room SHR is 0.80. Determine

i) room latent heat gain

ii) the apparatus dew point temperature

iii) the air supply to the room in m^3/min, if it is supplied to room at apparatus dew point temperature. [15]

8.a) Discuss the common considerations for humidification of air in air conditioning.

b) What are the different methods of humidifying the air? Explain the working of any one of the atomizing the water type humidifier. [15]

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