R16

Code No: 136DQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, November/December - 2020

REFRIGERATION AND AIR CONDITIONING

(Common to ME, MSNT)

Time: 2 hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

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1. An air refrigerator working on the principle of Bell-Coleman cycle. The air into the compressor is at 1 atm at -10^0C. It is compressed to 10 atm and cooled to 40^0C at the same pressure. It is then expanded to 1 atm and discharged to take cooling load. The air circulation is 1 kg/s. The isentropic efficiency of the compressor = 80%. The isentropic efficiency of the expander = 90%. Find the following: a) Refrigeration capacity of the system b) C.O.P of the system. Take $\gamma = 1.4$, Cp = 1.00 kJ/kg ^{0}C. [8+7]

2. A dense air refrigeration machine operating on Bell-Coleman cycle operates between 3.4 bar and 17 bar. The temperature of air after the cooler is 15^0C and after the refrigerator is 6^0C. For a refrigeration capacity of 6 tonnes, find: (a) Temperature after compression and expansion, (b) Air circulation required in the cycle per minute, (c) Work of compressor and expander, (d) Theoretical C.O.P and (e) Rate of water circulation required in the cooler in kg/min, if the rise in temperature is limited to 30^0C. [3+3+3+3+3]

3. A simple saturation cycle using F12 is designed for taking a load of 10 tones. The refrigerator and ambient temperatures are -1^0C and 30^0C respectively. A minimum temperature difference 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 = 1.2 for single cylinder, single acting compressor if it runs at 300 r.p.m. with volumetric efficiency = 0.9. [5+5+5]

4. A refrigerating plant of 28 kW capacity has its evaporation temperature -8^0C and condenser temperature of 30^0C. The refrigerant, R-12 is sub-cooled 5^0C before entering the expansion valve and the vapour is superheated 6^0C before leaving the evaporator coil. The compression of the refrigerant in the compressor is isentropic. If there is a suction pressure drop of 0.2 bar through the valves; and discharge pressure drop through the valve of 0.1 bar, determine the C.O.P. of the plant, theoretical piston displacements/min and the heat removed in the condenser. Solve the problem with the help of P-h chart. Give also a diagrammatic sketch of this cycle on the T-s chart. [15]

5.a) Give the comparison between air cooled and water cooled condenser. Explain in detail an evaporative condenser.

b) What is an azeotrope? Give some examples to indicate its importance. [8+7]

6.a) What are the desirable properties of refrigerants? Explain.

b) Compare the performance of Reciprocating and Centrifugal compressors. [8+7]

7.a) Draw a neat diagram of lithium bromide water absorption system and explain its working in major field of applications of this system.

b) Derive an expression for the COP of an ideal vapour absorption system in terms of temperature T_G at which heat is supplied to the generator, the temperature T_E at Which heat is absorbed in the evaporator and the temperature T_C at which heat is discharged from the condenser and absorber. [8+7]

8.a) With the help of a circuit diagram explain how a single air conditioning unit is used as an air-conditioner in summer and heat pump in winter.

b) Explain about Grills and Registers along with their performance effects. [8+7]

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