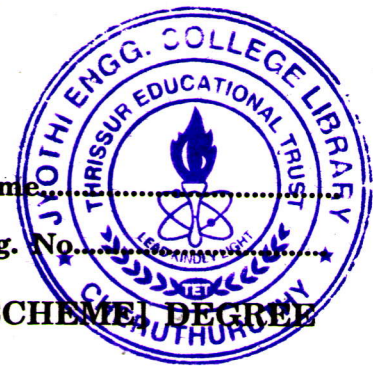


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Name

Reg. No.



SEVENTH SEMESTER B.TECH. (ENGINEERING) [2014 SCHEME] DEGREE
EXAMINATION, NOVEMBER 2017

Mechanical Engineering

ME 14 701—REFRIGERATION AND AIR CONDITIONING

Time : Three Hours

Maximum : 100 Marks

Part A

Answer any eight questions.
Each question carries 5 marks.

1. Explain the following terms :
(i) Refrigeration effect ; (ii) Ton of refrigeration ; (iii) C.O.P.
2. What are the limitations of reversed Carnot cycle in refrigeration ?
3. Describe the principle of thermoelectric refrigerator.
4. Distinguish between Dry and Wet compression in vapour compression refrigeration system.
5. Why in practice a throttle valve is used in vapour compression refrigerator rather than an expansion cylinder to reduce pressure between the condenser and the evaporator ?
6. With the help of psychrometric chart explain the following process and give the important characteristic features of adiabatic cooling and humidification process.
7. Define relative humidity, specific humidity, DBT, WBT, DPT.
8. Explain psychrometric process for summer air conditioning.
9. What is a function of a heat pump and what are the different heat pump circuits ?
10. State the name of different types of evaporative devices used in refrigeration system. Explain automatic expansion valve.

(8 × 5 = 40 marks)

Part B

Answer all questions.
Each question carries 15 marks.

11. (a) In simple air refrigeration system the regenerative cooling reduces the temperature of air from the heat exchanger by 200° C. before it expands through the cooling turbine. The air leaves the cabin at 270 °C. and the ram air temperature is 150° C. Obtain the amount of air bled from the refrigeration and COP. If 0.5 kg./s of air from the main compressor is used for the air conditioning. Calculate the power requirement and tonnage of the system. Take $P_{amb} = 0.8$ bar, $P_{ram} = 1$ bar, efficiency of compressor = 0.8, efficiency of turbine = 0.8, heat exchanger effectiveness is 0.75. The cool air leaves the regenerative heat exchanger at 270° C.

Or

Turn over

- (b) A Bell-Coleman cycle operates between the pressure limits of 1 bar and 8 bar. Air is drawn from the cold chamber at 9°C ., compressed and then it is cooled to 29°C . before entering the expansion cylinder. Expansion and compression follow the law $pV^{1.35} = C$. Calculate (i) theoretical C.O.P. of the system. For air $\gamma = 1.4$ and $C_p = 1.003\text{ kJ/kg}\cdot\text{K}$; (ii) Instead of polytropic processes of compression or expansion, if the process is carried out in adiabatic, what could be the theoretical C.O.P. of system ?
12. (a) A vapour compression refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry at the end of the compression and there is no under cooling of the liquid before the expansion valve. Determine (i) C.O.P. of the cycle and (ii) Capacity of the refrigerator if the fluid flow is at the rate of 5 kg/min .

Data :

Pressure (Bar)	Saturation Temp. (K)	Enthalpy (kJ/kg.)		Entropy (kJ/kg. K)	
		Liquid	Vapour	Liquid	Vapour
60	295	151.96	293.29	0.554	1.0332
40	261	56.32	322.58	0.226	1.2464

Or

- (b) An ammonia ice plant operates between a condenser temperature of 300°C . and an evaporator temperature of -200°C . It produces 10 tons of ice per day from water at 250°C . to ice at -100°C . Assuming simple saturation cycle, determine (i) the capacity of refrigerating plant ; (ii) mass flow rate of refrigerant ; and (iii) COP of the cycle.
13. (a) Air flowing at the rate of $100\text{ m}^3/\text{min}$ at 400°C . DBT and 50 % RH is mixed with another stream flowing at the rate $20\text{ m}^3/\text{min}$ at 260°C . DBT and 50 % RH. The mixture flows over a cooling coil whose whose ADP temperature is 100°C . and by-pass factor is 0.2. Find DBT and RH of air leaving the coil. If this air supplied to an air-conditioned where DBT of 260°C . and RH of 50 % are maintained, estimate (i) Room sensible heat factor and (ii) Cooling load capacity of the coil in tones of refrigeration.

Or

- (b) (i) Differentiate between central, district and unitary air-conditioning systems. (7 marks)
(ii) With a neat sketch, explain the working of a forced evaporation humidifier. (8 marks)
14. (a) What are different methods used for design of the ducts and explain advantages of each over other.

Or

- (b) (i) Write short notes on condensers and evaporators used for refrigeration industry.
(ii) Make the arrangement of heat pump when it is used for year round air conditioning.

[4 × 15 = 60 marks]