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ME 181 PE 15

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2021

BINA CHOWDHURY CENTRAL LIBRARY
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A.P. Hatki, Wapara,
Wahga, 781017

B.Tech. 7th Semester End-Term Examination

ME

REFRIGERATION

(New Regulation w.e.f. 2017 – 18 & New Syllabus w.e.f. 2018 – 19)

Full Marks – 70

Time – Three hours

The figures in the right-hand margin indicate the full marks against the respective questions.

Use of refrigerant charts and tables are allowed

Answer question No. 1 and any *four* from the rest.

1. A. With reasons discuss the requirements of a good refrigerant with respect to the following properties:

(5)

- (i) Liquid specific heat
- (ii) Specific volume
- (iii) Latent heat of vapourization
- (iv) Boiling point
- (v) Critical temperature and pressure

B. Give the chemical formula for the following refrigerants:

- (i) R-12
- (ii) R-13B1
- (iii) R-718
- (iv) R-1270
- (v) R-290

(5)

[Turn over

2. (a) Distinguish between heat engine, refrigerator and heat pump.
- (b) A Carnot refrigerator requires 1.3 kW per tonne of refrigeration to maintain a region at low temperature of -38°C . Determine:
- COP of the Carnot refrigerator
 - The ratio of the higher and lower temperature $\left[\frac{T_1}{T_2}\right]$
 - The heat delivered and COP when this device is used as a heat pump. (8+7)
3. (a) A vapour compression machine is used to maintain a temperature of -23°C in a refrigerated space. The ambient temperature is 37°C . The compressor takes in dry saturated vapour of R-12. A minimum 10°C temperature difference is required at the evaporator as well as at the condenser. There is no sub-cooling of liquid. If the refrigerant flow rate is 1 kg/min, find
- Tonnage of refrigeration
 - Power requirement
 - Ratio of COP of this cycle to COP of Reversed Carnot Cycle
- (b) Differentiate between 'Zeotropic' and 'Azeotropic' refrigerant blends. (10+5)
4. (a) With a neat sketch explain the principle and working of "Electrolux Refrigerator". What is the function of hydrogen in this system? State the advantages and disadvantages of this system over conventional refrigerators.
- (b) What is the function of the throttle valve used in vapour compression refrigerator? Where is it used? (12+3)
5. A simple air refrigeration system is used for an aeroplane to take a load of 20 TR. Atmospheric temperature and pressure are 23°C and 0.9 bar. The pressure of air is increased due to isentropic ramming from 0.9 bar to 1 bar. The pressure of the air leaving the main compressor is 3.5 bar and 60 % of its heat is removed in the air-cooled heat exchanger and then it is passed through an evaporator for further cooling. The temperature of the air is reduced by 7°C in the evaporator. Lastly the air is passed through cooling turbine and then it is supplied to the cooling cabin where the pressure is maintained at 1.03 bar
- Assuming isentropic efficiencies of the compressor and turbine are 80% and 75%, find,
- Mass flow rate of air passing through the cabin
 - Power capacity (kW) required to take the load in the cooling cabin.
 - C.O.P. of the system.
- (2) The temperature of the air leaving the cabin should not exceed 25°C . (15)

6. (a) With a neat sketch explain working of Steam Jet Air Refrigeration System.
- (b) What is the basic function of a compressor in vapour compression refrigeration system? How is this function achieved in vapour absorption system? (10+5)
7. (a) What is meant by multistage or compound compression used in VCR system? What is meant by perfect intercooling in multistage compression? List the advantages of multistage or compound compression with intercoolers.
- (b) In an 18 TR vapour absorption refrigeration system, the heating in the generator is carried out at 133°C . The refrigeration temperature is -10°C . The condensation of the refrigerant is carried out at 30°C using cooling water. Find the maximum COP of the system. If the actual COP is 40% of the maximum COP, find the heat supplied in the generator. (8+7)
8. Write short notes (any three): (3 × 5 = 15)
- (a) Ice making by nocturnal cooling
- (b) Non-isothermal Refrigeration
- (c) Vortex Tube
- (d) Dry Air Rated Temperature (DART)
- (e) Manufacture of dry ice

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