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Reg. No. : .....

Name : .....

Seventh Semester B.Tech. Degree Examination, October 2018
(2013 Scheme)
13.704 : REFRIGERATION AND AIR CONDITIONING (M)

Time : 3 Hours Max. Marks : 100

Instructions : *1) **Use** of Psychrometric chart and Refrigeration properties table permitted.*
*2) Answer **all** questions from Part – **A** and **any four** full questions from Part – **B**.*

PART – A

Answer **all** questions; **each** question carries **2** marks.

1. What are the limitations of reversed Carnot cycle ? Explain.
2. What are the merits and demerits of air refrigeration systems ?
3. What are the effects of evaporator and condenser pressure over the COP of a vapour compression refrigeration system ?
4. Discuss the significance of terms ODP and GWP in connection with refrigerants.
5. Give the concept of steam jet refrigeration.
6. What do you mean by plate freezing ?
7. What is a hermetically sealed compressor ? Where is it used ? What are its advantages ?
8. Distinguish between relative humidity and specific humidity in connection with psychrometric properties of moist air.
9. Explain about effective temperature and comfort charts in summer air-conditioning systems.
10. Why fresh air is provided in air-conditioning systems ? Explain its significance.

(10×2=20 Marks)

P.T.O.

PART – B

Answer **any one** full question from **each** Module; **each** carries **20** marks.

Module – I

11. a) A cold storage plant is required to store 20 tonnes of fish. The temperature of the fish when supplied = 25°C; storage temperature of fish required = – 8°C. specific heat of fish above freezing point = 2.93 kJ/kg°C; specific heat of fish below freezing point = 1.25 kJ/kg°C; freezing point of fish = – 3°C. Latent heat of fish = 232 kJ/kg.
If the cooling is achieved within 8 hours find out :
    i) Capacity of the refrigerating plant
    ii) Carnot cycle COP between this temperature range
    iii) If the actual COP is 1/3rd of the Carnot COP, find out the power required to run the plant. **10**

b) Derive the expression for COP of Reversed Joule Cycle if the processes of compression and expansion are considered to be
    i) polytropic
    ii) isentropic. **10**

OR

12. a) Describe with neat sketches the working of regenerative type of air-craft refrigeration system. Write the expressions for mass flow rate of air, power required and COP of refrigeration system. **10**

b) i) Bring out the advantages of air refrigeration systems over other modes of refrigeration systems. **6**
    ii) What do you mean by Dry Air Rated Temperature (DART) in connection with air-refrigeration systems ? Explain. **4**

Module – II

13. a) Show the arrangement of at least two different schemes of arranging multiple evaporator and multi stage compression with flash intercooling with the help of neat sketches and supportive P-h diagrams. **10**

b) What is a Liquid Suction Heat Exchanger ? Where it is used and why ? Explain with neat sketches and supportive P-h diagram. **10**

OR

14. A food storage locker requires a refrigeration system of 2400 kJ/min capacity at an evaporator temperature of 263 K and a condenser temperature of 303 K. The refrigerant used is Freon-12. It is sub cooled by 6°C before entering the expansion valve and vapour is superheated by 7°C before leaving the evaporator coil. The compression of refrigerant is reversible adiabatic. The refrigeration compressor is two cylinders single-acting with stroke equal to 1.25 times the bore and operates at 1000 rpm. Properties of Freon-12 are as follows :

Saturation temperature K	Absolute Pressure bar	Specific Volume Vapour M^3/kg	Enthalpy kJ/kg		Entropy kJ/kgK	
			Liquid	Vapour	Liquid	Vapour
263	2.19	0.0767	26.9	183.2	0.1080	0.7020
303	7.45	0.0235	64.6	199.6	0.2399	0.6854

Take : Liquid specific heat = 1.235 kJ/kgK, vapour specific heat = 0.733 kJ/kgK.

Determine :

i) Refrigerating effect per kg

ii) Mass of refrigerant to be circulated per minute

iii) Theoretical piston displacement per minute

iv) Theoretical power required to run the compressor, in kW

v) Theoretical bore and stroke of compressors. **20**

Module – III

15. a) Describe the working of Ammonia water absorption refrigeration system with neat sketches. What are its advantages ? **10**

b) Explain the different food preservation methods. **10**

OR

16. a) Describe with neat sketches the working of ice plant. **10**

b) Describe the role of condenser performance in deciding the COP of vapour compression refrigeration system. **10**

Module – IV

17. a) Write short notes on the following in connection with moist air :
    1) Dry bulb temperature
    2) Wet bulb temperature
    3) Specific humidity
    4) Relative humidity
    5) Enthalpy of moist air. **10**

    b) Describe the air conditioning system used in :
    i) Restaurants
    ii) Cinema theatre. **10**

OR

18. a) Distinguish between Room air conditioner and split air-conditioner with the help of neat sketches. **10**

    b) An air-conditioned space is maintained at 27°C DBT and 50% RH. The ambient conditions are 40°C DBT and 27°C WBT. The space has a sensible heat gain of 14 kW. Air is supplied to the space at 7°C saturated.

    Calculate :
    i) Mass of moist air supplied to the space in kg/h
    ii) Latent heat gain of space in kW
    iii) Cooling load of the air washer in kW if 30% of the air supplied to the space is fresh, the remainder being recirculated. **10**