

#2017

EC-126

B.E. VII Sem. (CGPA) Mechanical Engineering Exam. 2012-13 REFRIGERATION AND AIR CONDITIONING

Paper : M-702

Time Allowed : Three Hours

Maximum Marks : 60

Note: Attempt any five questions. All questions carry equal marks. Use of refrigeration table and psychrometric chart is permitted. Assume suitable data if necessary.

- Q.1. a) Define tonnes of refrigeration. Write different between refrigerator and heat pump. 4 b) A cold storage plant is required to store 20 tonnes of fish. The fish is supplied specific heat of fish below freezing point is 1.26 kJ/kgk. The fish is stored in cold storage which is maintained at -8°C. The freezing point of fish is -4°C, the latent heat of fish is 235 kJ/kg. If the plant requires 75 KW to drive it find: i) The capacity of the plant. ii) Time taken to achieve cooling. Assume actual C.O.P. of the plant as 0.3 of the carnot C.O.P. 8

- Q.2. a) Draw P-V & T-S diagram for theoretical vapour compression cycle. 4

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An aircraft refrigeration plant has to handle a cabin load of 30 tonnes. The atmospheric temperature is 17°C. The atmospheric air is compressed to a pressure of 0.95 bar and temperature of 30°C due to ram action. This air is then further compressed in a compressor to 4.57 bar, cooled in a heat exchanger to 67°C, expanded in a turbine to 1 bar pressure and supplied to the cabin. The air leaves the cabin at a temperature of 27°C. The isentropic efficiencies of both compressor and turbine are 0.9. Calculate the mass of air circulated per minute and the C.O.P. for air, Cp = 1.004 kJ/kg k and Cp/Cv = 1.4. 8

- Q.3. a) Draw schematic and P-h diagrams of a two stage compression system with water intercooler, liquid intercooler and a liquid flash chamber. 4 b) A food storage chamber requires a refrigeration system of 12 TR capacity with an evaporator temperature of -8°C and condenser temperature of 30°C. The refrigerant R-12 is subcooled by 5°C before entering the throttle valve, and the vapour is superheated by 6°C before entering the compressor. If the liquid and vapour specific heat are 1.235 and 0.733 kJ/kgk respectively, find: (1) refrigerating effect per kg, (2) mass of refrigerant circulated per minute and 3. Coefficient of performance. The relevant properties of the refrigerant R-12 are given below: 8

Saturation temperature °C	Enthalpy, kJ/kg		Entropy kJ/kg k	
	liquid	vapour	liquid	Vapour
-8	28.70	184.06	0.1148	0.7007
30	64.59	199.62	0.2400	0.6853

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Q.4. a) What are the function of the following components in an absorption system: 4

i) Absorber ✓ ii) Rectifier ✓  
 iii) Analyser ✓ iv) Heat exchangers ✓

b) Describe the following refrigerant, also write their chemical formulas- 6

i) Halo-carbon refrigerants -- 295  
 ii) Azeotropic refrigerants -- 293 K  
 iii) Inorganic refrigerants -- 301  
 iv) Hydro-carbon refrigerants -- 102

Q.5. a) Explain with diagram thermostatic expansion valve. 4 K  
 b) Sketch and explain a cascade refrigeration system. Draw cascade refrigeration cycle on temperature-entropy and pressure enthalpy diagrams. 4 K  
 c) Explain the working of a system used for the production of dry ice. K-730 4

Q.6. a) Explain, with the help of a neat sketch, the working of a steam jet refrigeration system. 4  
 b) Write different psychrometric terms and write their definitions. K-768 4  
 c) The atmospheric conditions of air are 25°C dry bulb temperature and specific humidity of 0.01 kg per kg of dry air. Find: 1) partial pressure of vapour, 2) Relative humidity, and 3) Dew point temperature. K-524B

Q.7. a) D.B mall fun cinema hall of seating capacity 1500 persons has been provided with an air conditioned plant with the following data  
 Outdoor conditions = 40°C DBT & 20°C WBT  
 Required indoor conditions = 20°C DBT & 60% RH

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Amount of outdoor air supplied = 0.3m<sup>3</sup>/min/person  
 If the required condition is achieved first by adiabatic humidity and then by cooling, find (1) The capacity of cooling coil and surface temperature of the coil if by pass factor is 0.25; and (2) the capacity of the humidifier and its efficiency. 6

The following data refer to an air-conditioning system of a ashima cinepolis hall for winter conditions:  
 Outdoor conditions = 10°C DBT, 60% RH  
 Required comfort conditions = 22°C DBT, 60% RH  
 Seating capacity = 2000  
 Amount of outdoor air supplied = 0.25m<sup>3</sup>/min/person  
 The required condition is achieved by heating, humidifying and then again by heating. The air coming out of the humidifier is having 75% relative humidity. Find (a) the heating capacity of the first heater in KW and the surface temperature of the coil if its by-pass factor is 0.3. (b) the capacity of the humidifier in kg/hr and (c) The heating capacity of the second heater and its by-pass factor, if the surface temperature of the coil is 25°C. 6

Q.8. Write a short notes on any three of the following: 12

i) Effective temperature. K-538  
 ii) Human comfort.  
 iii) Vortex tube. 12 th  
 iv) Triple point. 16 CP  
 v) Cryogenics.

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