Dec' 2023

TE Sem VI (R-2019 C Scheme) "Mechanical"

5/12/2023

[Max Marks:80]

Duration: 3hrs

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.
(5) Use of Refrigerant tables, Friction charts, Psychometrics chart, and Steam table are permitted.

[20]

Qu.1		Attempt any Five of the following
	a)	Define the i) Refrigeration ii) Ton of refrigeration iii) Air conditioning iv) Coefficient of performance
	b)	Explain difference between vapour compression refrigeration system and vapour absorption refrigeration system
	c)	Define the term 'by pass factor' Express it for heating and cooling coil.
	d)	State the various applications of HVACR and explain any one application
	f)	Classifiy of heat pump and its application in an industry
	g)	Define the effective temperature. What are physiological hazards resulting from heat?
	h)	Name the different types of air refrigeration system used for the cooling of the aircraft cabin. Draw bootstrap air refrigeration cycle with neat schematic

Qu.2 a) Draw a schematic diagram of vapour compression system. Discuss the **[08]** effect of change in evaporator and condenser pressure on the performance of standard VCR cycle with the help of P-H diagram.

b) An air refrigeration system used for food storage provides 25 tons of **[12]** refrigeration. The temperature of air entering the compressor is 7°C and temperature at exit from the cooler is 27°C. The quantity of air circulated in the cooler is 3000 kg/hr. Both the compression and expansion follows the polytropic law $PV^{1.3} = C$. Calculate COP of the cycle and power required by the compressor per ton of refrigeration.

Qu.3 a) Explain the types of refrigerants, numbering system for halocarbon **[08]** refrigerants with example.

b) A Simple NH_3 Vapor compression system has compressor with piston **[12]** displacement of 3 m^3/ min, a condenser pressure of 12 bar and evaporator pressure of 2.5 bar. The liquid is subcooled to 20°C by soldering the liquid line to suction line. The temperature of vapour leaving the compressor is 100°C heat rejected to compressor cooling water is 6000 KJ/hr and volumetric efficiency of compressor is 0.8. 1) Find capacity of the system 2) Indicated power 3) COP of the system. Draw P-H and T-S Diagram. Use PH Chart.

Q4b) The load on a 75×75 mm 360^0 hydrodynamic bearing is 12.5 KN. Journal speed 2000 rpm and viscosity of oil 10 CP. Clearance ratio $\frac{1}{1000}$. Calculate.

1) The minimum oil film thickness.
2) The coefficient of friction.
3) Power lost in friction.
4) The total oil flow rate.
5) Rise in temperature of bearing.

Q5a) Determine size of rubber canvas flat belt to transmit 5.5 KW power from an electric motor rotating at 960 rpm to an intermediate shaft of machine tool. The reduction ratio is 2.8 approximately and expected life is 1200 hours.

Q5b) Calculate the factor of safety on breaking load for a chain 10A-2 DR50 which is used to transmit 15 KW design power. The input speed is 960 rpm and reduction ratio is 2.90.

Q6a) A helical spring is subjected to the load varying from 500 N to 1100 N, having spring index 15 of 6, free length of spring is to lie between 100 mm to 150 mm. The maximum compression under variation of load is 3 cm. Assuming stresses for spring material and $G = 0.8 \times 10^5$ N/mm². Design the spring and find the energy stored in the spring.

Q6b) State different theories of failure and explain any two in details.