Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 712102N **Date: 17/05/2016**

Subject Name: ADVANCED REFRIGERATION

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the working principle of steam jet refrigeration cycle with neat sketch and depicts the various state point of the system on T-s diagram. **07**

(b) Why is HCFC-22 needed to be phased out? Name the refrigerants which can replace HCFC-22 **07**

Q.2 **(a)** A refrigeration plant comprises three evaporators of capacities 30 TR at -10 °C, 20 TR at 5 °C and 10 TR at 10°C with single compressor, multiple expansion valves and back pressure valves. The condenser is operating at 40 °C and sub-cooling of liquid is done up to 30°C. All the evaporators discharge dry and saturated refrigerant of R12 to the compressor. Assuming isentropic compression, determine: (i) the mass of refrigerant flowing through each evaporator (ii) the power required to drive compressor (iii) the COP of system **07**

(b) What is the difference between multi-stage refrigeration and cascade refrigeration? **07**

OR

(b) Explain with neat sketch and p-h diagram the multiple evaporators VCR system having different temperatures and employed with single compressor, individual expansion valves and back pressure valves. **07**

Q.3 **(a)** The weak aqua- ammonia solution at 100℃ temperature and 16 bar pressure leaves the generator and enters a heat exchanger. The temperature of the weak aqua-ammonia solution leaving the heat exchanger is 50℃. Determine the heat regained by the strong aqua-ammonia solution in the heat exchanger using enthalpy and concentration (h-c) diagram. **07**

(b) Explain the working of regenerative air refrigeration system with a neat sketch and T-s diagram. **07**

OR

Q.3 **(a)** A boot strap cooling system of 10 TR capacity is required for an aeroplane cabin. The temperature and pressure conditions of the atmosphere are 20°C and 0.85 bar respectively. The pressure of air is increased from 0.85 bar to 1 bar due to ramming action. The pressure of air leaving the main compressor and auxiliary compressors are 3 bar and 4 bar respectively. The isentropic efficiency of both the compressor is 80% and of turbine is 85%. 50% of total heat of air leaving the main compressor is removed in the first heat exchanger and 30 % of total heat of the air leaving the auxiliary compressor is removed in the second heat exchanger using rammed air.

Assuming that ramming is isentropic and cabin pressure is 0.9 bar and Temperature of air leaving the cabin should not exceed 20°C, find the followings

(a) Power required to take the load in the cabin

(b) COP of the system

(b) State the function of following components in an absorption system **07**

(1) Absorber (2) Rectifier (3) Analyser and (4) Heat exchangers.

Q.4	**(a)**	The dry and saturated steam at 8 bar pressure passes to steam ejector water vapour refrigeration system. The temperature of water in flash chamber is 5°C. Make up water is supplied at 20°C. The absolute pressure in the condenser is 0.06bar. The nozzle efficiency 86 %, the entrainment efficiency is 64 % and compression efficiency is 80 %. The quality of the motive steam and flashed vapour mixed together at the beginning of compression is 90 % dry. Determine (i) Mass of motive steam required per kg of flashed vapour (ii) Refrigeration effect per kg of flashed vapour.	**07**
	(b)	Define the figure of merit related to Thermoelectric refrigeration system and explain its effect on COP of the system	**07**
		OR	
Q.4	**(a)**	Explain the balancing of compressor and capillary tube in VCR system and effects of unbalanced conditions in compressor-capillary tube system	**07**
	(b)	Explain the working principle of thermo-electric refrigeration system and discuss the field of its applications	**07**
Q.5	**(a)**	Describe a cold storage. Does it preserve frozen foods only? What factors are considered in the design of the same?	**07**
	(b)	Explain the use of "heat pump" for heating and cooling cycle with neat sketch.	**07**
		OR	
Q.5	**(a)**	What are the characteristics of good lubricant? Also explain various Lubrication methods	**07**
	(b)	Explain the various methods of transport refrigeration.	**07**

****