Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I EXAMINATION – SUMMER 2017

Subject Code: 2711003 **Date:11/05/2017**

Subject Name: Advanced Refrigeration

Time:02:30 p.m. to 05:00 p.m. **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of refrigerants data book is permitted**

Q.1 **(a)** Discuss in brief about primary and secondary refrigerants. What are azeotropic refrigerants? Give some examples to indicate its importance. **07**

(b) Explain the balancing of compressor and capillary tube in VCR system and effects of unbalanced conditions in compressor-capillary tube system. **07**

Q.2 **(a)** Differentiate between simple air-refrigeration system and bootstrap air refrigeration system. **07**

(b) The following data refer to a simple aircraft refrigeration system: **07**

Ram air temperature and pressure : 30℃ and 1atm

Pressure at the exit of main compressor: 4.5 bar

Cabin air temperature and pressure : 27℃ and 1bar

η_c = compressors efficiency = 84%

η_t = turbine efficiency = 80%

ϵ = heat exchanger effectiveness = 80%

Cooling load = 21 kW

Determine (a) tonnage (b) mass of the bled air from the main compressor (c) heat rejection (d) the power required to operate the system and (e) the COP of the system (f) power required for blower

OR

(b) Draw a neat sketch, the temperature-entropy and the enthalpy-entropy diagram of a steam jet refrigeration system and explain its working principle. **07**

Q.3 **(a)** Explain with neat sketch and p-h diagram of the two stage VCR system having flash gas removal, water and flash intercooler and also liquid sub-cooler. **07**

(b) The refrigeration system using R-22 as refrigerant consists of three evaporators with a common condenser. The temperature in three evaporators is maintained at -15℃, 0℃ and 15℃ respectively. The condenser temperature is 40℃ and the liquid refrigerant leaving the condenser is sub-cooled to 30℃.The vapor leaving the evaporators are dry and saturated vapor. The refrigerant coming from evaporators at high pressures is reduced to low pressure with the help of back pressure valves. The mass flow rate of refrigerant flow through evaporators is 2 kg/s, 3 kg/s and 5 kg/s respectively. Calculate refrigerating capacity of each evaporator and COP of system. **07**

OR

Q.3 **(a)** Which is better thermodynamically multi-stage refrigeration or cascade refrigeration system? **07**

(b) A 20 TR capacity compound ammonia VCR system employs flash gas removal, water and flash intercooler. System operates between pressure limits of 1 bar and 10 bars. The pressure in water and flash intercooler is 4 bars. Vapor ammonia is cooled to 20 ℃ in water intercooler in between stage. The liquid refrigerant is sub-cooled to 10℃. Draw the cycle on p-h chart and calculate (i) refrigerant **07**

passing through evaporator (ii) total power required to run the system (iii) COP of the system

Q.4	**(a)**	State the functions of the following components in an absorption system: (i) Absorber (ii) Rectifier (iii) Analyser and (iv) Heat exchangers	**07**
	(b)	Draw a neat compact diagram of LiBr-H_2O absorption refrigeration system and explain its working. List-out the major fields of applications of this refrigeration system.	**07**

OR

Q.4	**(a)**	In 18 TR absorption refrigeration system the heating in generator is carried out by using steam at 3 bar and 85% dry. The refrigeration temperature is -10 ℃. The condensation of the refrigerant is carried out at 30 ℃ using cooling water. Determine (i) maximum possible COP of the system and (ii) Quantity of steam required per hour to run the plant if the steam leaves the generator as saturated water at same pressure. Assume relative COP = 0.4	**07**
	(b)	What is the basic function of compressor in VCR system? How this function is achieved in VAR system?	**07**
Q.5	**(a)**	Write a short note on refrigerated trucks used to transport large quantities of fresh and frozen perishable products.	**07**
	(b)	Explain the application of refrigeration for food preservation. Explain how the refrigeration controls the spoilage of food.	**07**

OR

Q.5	**(a)**	What is heat pump? Explain in brief different types of heat pumps	**07**
	(b)	Discuss factors to be kept in mind while storing the food in cold storage.	**07**

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