Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– II(New course) • EXAMINATION (Remedial) – WINTER- 2015

Subject Code: 2722109 **Date: 09/12/2015**

Subject Name: Advanced Refrigeration Engineering

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)** What is a minimum boiling azeotrope? Explain its behavior on a T-x diagram and compare the same with the behavior of maximum boiling azeotrope. **07**

(b) Describe with the help of a neat sketch the working of the steam jet refrigeration cycle. Show the various state points and process on the T-s diagram. **07**

Q.2 **(a)** Explain with a neat sketch the working principle of automatic expansion valve. **07**

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

Ram air temperature and pressure : 30℃ and 1 atm

Cabin air temperature and pressure : 27℃ and 1 atm

Pressure at the exit of main compressor: 4.5 bar

ϵ = Heat Exchanger effectiveness: 0.8

η_c = compressor efficiency = 0.84

η_e = expander efficiency = 0.80

Cooling Load = 21 kW

Determine:

(a) Mass of the bled air from the main compressor

(b) Heat rejection

(c) Power

(d) COP

OR

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

Q.3 **(a)** Discuss how capillary tube balances with compressor. **07**

(b) A single compressor refrigeration system charged with R-22 refrigerant is having three evaporators with individual expansion valve and back pressure valves and a common condenser. The temperature in three evaporators is to be maintained at 15℃, 0℃ and -15℃ having refrigerant mass flow rate though them is of 5kg/s, 3kg/s and 2kg/s respectively. The condenser temperature is 40℃ and liquid coming out of the condenser is subcooled to 30℃. The vapor leaving the evaporators is dry and saturated vapor. Assuming isentropic compression determine the refrigerating capacity of each evaporators and COP of system. **07**

OR

Q.3 **(a)** What is cascade refrigeration system? Why and where does this system find itself particularly useful? **07**

(b) A two stage refrigeration system charged with R-134a refrigerant operates between the pressure limits of 1.3 bar and 7.7 bar. The refrigerant leaves the condenser as a saturated liquid and is throttled to a flash chamber operating at 2.9 bar. The part of refrigerant evaporates during the flashing process is mixed **07**

with the refrigerant leaving the low pressure compressor. Then the mixture is compressed to the condenser pressure by the high pressure compressor. The liquid in the flash chamber is throttled to the evaporator pressure and cools the refrigerated space. The refrigerant entering lower stage compressor is saturated vapor. The mass of refrigerant circulates through condenser is 8 kg/min, Calculate power required by the compressors and COP of the system.

Q.4	**(a)**	State the function of following components in an absorption system (1) Absorber (2) Rectifier (3) Analyser and (4) Heat exchangers	**07**
	(b)	Explain with neat sketch practical single ï effect LiBr-H2O vapor absorption chiller.	**07**

OR

Q.4	**(a)**	Is it proper to compare COPôs of Vapor Absorption and Vapor Compression systems obtained on the basis of different forms of energy? Discuss your opinion.	**07**
	(b)	The weak aqua- ammonia solution at 100°C 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°C. Determine the heat regained by the strong aqua-ammonia solution in the heat exchanger using enthalpy and concentration (h-c) diagram.	**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 in brief about marine refrigeration	**07**

OR

Q.5	**(a)**	Describe with neat sketch a two stage VCR system employed with flash gas removal, water and flash intercooler and also a liquid subcooler along with P-h diagram of the cycle.	**07**
	(b)	Discuss various methods of food preservation	**07**

****