Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2161410 **Date: 05/05/2017**

Subject Name: Low Temperature Process Systems For Foods

Time: 10:30 AM to 01:00 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		Answer the following questions:	**14**
	1	Define refrigerant.	
	2	Name five refrigerants used in simple VCR system?	
	3	Define 1TR and show that 1TR =3.5157 kW	
	4	What is the function of rectifier in VARS?	
	5	Why are CFC/HCFC considered harmful for our environment?	
	6	Give R designation of C_2H_6.	
	7	What are zeotropes? Give example.	
	8	What is the function of evaporator in simple VCR system?	
	9	Define COP of VARS system.	
	10	State the economic criteria for refrigerant selection.	
	11	What is AHU?	
	12	Define 1TR.	
	13	What are cryogenic fluids? Give example.	
	14	Differentiate between chilling and freezing.	
Q.2	**(a)**	Explain the following: (i) Halide torches (ii) Green house effect	**03**
	(b)	An ammonia based deep freezer produces 50 TR refrigeration capacity. The cycle operates between 25 0^oC and –15 0^oC. The ammonia vapours are dry and saturated at the end of compression. If the COP of the system is 50% of the maximum possible, calculate (i) Power required to drive the compressor in kW (ii) Heat rejection ratio (HRR)	**04**

(c) A simple VCRS is operating with R134a under the following conditions: **07**
Evaporating temperature = –15 ^oC , Condensing temperature = 35 ^oC
COP of the system = 4, Mass flow rate of the refrigerant = 0.4 kg/s.
Calculate the following:
(i) Refrigeration capacity in TR (ii) Compression ratio.
(iii) Compressor power requirement in kW. (iv) Carnot COP of the system.
(v) Refrigeration efficiency in %.
(vi) Enthalpy of vapours exiting the compressor.
(vii) Quality of refrigerant entering evaporator.

Thermodynamic Properties of R134a					
Temperature ^oC	h_f (kJ/kg)	h_g (kJ/kg)	P (kPa)	s_f (kJ/kgK)	s_g (kJ/kgK)
- 15 ^oC	180	390	164	0.9257	1.738
35^oC	249	418	888	1.168	1.714

OR

(c) Explain simple VCR system with the help of a neat flow diagram and P-h phase diagram. Explain the effect of the following on performance of a simple VCR system: (i) Increase in condenser temperature (ii) Vapour superheating. **07**

Q.3 (a) Explain the functions of the following components in a vapour absorption refrigeration cycle: **03**
1. Generator 2. Absorber

(b) Derive an expression for COP of a VARS in terms of generator temperature, condensing temperature and evaporating temperature. **04**

(c) Explain LiBr-H_2O based vapour absorption refrigeration system with a neat flow diagram. **07**

OR

Q.3 (a) An absorption type refrigeration system is operating with heating, cooling and refrigeration temperatures set at 97°C, 23°C and -10°C respectively. Calculate the theoretical COP of the system. **03**

(b) Explain cascade refrigeration cycle. **04**

(c) Explain NH_3-H_2O based vapour absorption refrigeration system with a neat flow diagram. **07**

Q.4 (a) Give a classification of refrigerant compressors and explain Hermetic compressors. **03**

(b) Explain the following briefly with diagrams: **04**
(i) Shell and tube evaporator
(ii) Air Washer

(c) Explain the operation of an evaporative condenser with a neat flow diagram. **07**

OR

Q.4 (a) Answer the following: **03**
(i) What are FAN laws?
(ii) Name type of air filters used in A/c.
(iii)What do you mean by number of air changes?

(b) Write brief notes in 1-2 lines: **04**
(i) Criteria for fan selection
(ii) Sensing elements for pressure measurement
(iii)Aspect ratio
(iv)Types of fans and blowers.

(c) Explain the construction and working of flooded evaporator with a neat flow diagram. **07**

Q.5 (a) For a fixed fan calculate the percentage increase in air flow rate and power consumption if fan speed is doubled. **03**

(b) Explain the working of cooling towers with a diagram. **04**

	(c)	Define cold stores, CA storage and MA storage. Write a short note on Individual quick freezing (IQF) and mention its applications.	**07**

OR

Q.5	**(a)**	Explain the following: (i) Ante room (ii) Wet scrubbers (iii) Humidistat	**03**
	(b)	Explain fan characteristics with the help of 'Pressure Versus Flow' diagram. For a fixed fan, calculate the percentage increase in air volume flow rate and power consumption if the fan speed is increased by 50%.	**04**
	(c)	Explain the fundamental design considerations of a cold storage plant suitable for fruits and vegetables.	**07**

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