Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (NEW).EXAMINATION – WINTER 2016

Subject Code: 2161908 **Date: 22/10/2016**

Subject Name: Refrigeration and Air Conditioning

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.**
4. **Use of psychrometric chart and steam table is permissible.**

Q.1 **(a)** Explain with neat schematic diagram simple air refrigeration system also draws its T-s plot. **07**

(b) Explain following terms **07**

(1) Flash chamber
(2) Aspect ratio
(3) Humidity ratio
(4) Dew point temperature
(5) Hermetically sealed compressor
(6) Grand Sensible Heat Factor
(7) Secondary refrigerant

Q.2 **(a)** A food storage requires a refrigeration capacity of 12 TR and works between the evaporative temperature of -8°C and condensing temperature of 30°C. The refrigerant R-12 is sub cooled by 5°C before entering expansion device and vapour is superheated to -2^{O}C before leaving to evaporator coil. (1) Draw p-h diagram for the process and find out (2) C.O.P. (3) power required in kW/TR. **07**

Saturation Temperature	Saturation Pressure	Enthalpy (kJ/kg)		Entropy (kJ/kg K)	
(^{O}C)	(bar)	Liquid	Vapor	Liquid	Vapor
-8	2.354	28.72	184.07	0.1149	0.7007
30	7.451	64.59	199.62	0.24	0.6853

Take specific heat of liquid R-12 as 1.235 kJ/kg K and vapour R-12 as 0.733 kJ/kg K

(b) Explain with neat schematic diagram, working of two stage compression system with water intercooler, liquid subcooler and flash intercooler. Also draw p-h diagram. **07**

OR

(b) A dense air refrigerator operating on Bell-Coleman cycle works between 3 bar and 15 bar. The temperature of air after the evaporator and after cooler is 5°C and 20 ^{O}C respectively. The evaporator extracts 2000 kg/min of heat from the space to be cooled. Calculate (1) amount of air required in the cycle per minute, (2) power required to run the system, (3) COP and (4) mass flow rate of water per minute in cooler if rise in temperature of water is 20 ^{O}C. **07**

Assume isentropic compression and expansion, C_p=1.008kJ/kg K, γ=1.4 for air and for water C_p=4.18 kJ/kg K.

Q.3 **(a)** Explain working of theoretical aqua ammonia vapour absorption refrigeration system with neat sketch. Also state few selection criteria for vapor absorption refrigeration system. **07**

(b) The barometer for air reads 750 mm of Hg. The DBT and WBT measured using sling psychrometer is 33°C and 23°C respectively. Calculate (1) Vapor pressure (2) Relative humidity (3) Humidity ratio (4) Dew point temperature (5) specific enthalpy (6) wet bulb depression and (7) dew point depression **07**

OR

Q.3	**(a)**	What is the function of expansion device? Explain automatic expansion valve with neat sketch.	**07**
	(b)	Air at $30^{O}C$ DBT and 60% RH enters over cooling coil at rate $250m^3$/min. If effective surface temperature of coil is $12^{O}C$ and bypass factor is 0.1 then name the process undergone by air and calculate temperature of air leaving coil, refrigerating effect in TR, mass of water vapor condensed and SHF.	**07**
Q.4	**(a)**	List out applications of refrigeration and explain ice plant with neat sketch	**07**
	(b)	Derive the formula of equivalent diameter of circular duct for rectangular duct when (1) the quantity of air carries in both the ducts is same and (2) the velocity of air in both the ducts is same.	**07**

OR

Q.4	**(a)**	List out factors governing human comfort. Define Effective Temperature. Explain five factors governing optimum effective temperature.	**07**
	(b)	Classify refrigerants briefly and explain four thermodynamic properties of refrigerants.	**07**
Q.5	**(a)**	What are IHG and ICL? Explain flywheel effect of building material on peak load and time lag of heat load with neat sketch.	**07**
	(b)	Explain ventilation and infiltration in brief. Also calculate total infiltration air in m^3/min and load due to outside air for the Restaurant. Take Inside design condition 26 ^{O}C DBT, specific humidity 11.1 gm/kg of dry air and Outside design condition 42 ^{O}C DBT, specific humidity 16.4 gm/kg of dry air. Size of room is 18x18x4 meter, No. of air changes required/hr is 1.5, No. of occupants 100, door open/hr/occupant is 3 and usage factor for swinging door is 3.	**07**

OR

Q.5	**(a)**	List out methods for duct design and explain equal friction loss method with its advantages and disadvantages.	**07**
	(b)	Classify air conditioning systems and explain summer air conditioning system with neat sketch.	**07**

****