

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- VI EXAMINATION – SUMMER 2020****Subject Code: 2161908****Date: 04/11/2020****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 refrigeration and air-conditioning charts and tables is permitted.

		MARKS
Q.1	(a) Establish the relationship between COP and KW per ton of refrigeration.	03
	(b) A sling psychomotor reads 40°C DBT and 28°C WBT, Calculate the specific humidity, relative humidity, vapor density, dew point temperature, and enthalpy using refrigeration and air conditioning tables.	04
	(c) An auditorium is to be air conditioned for a seating capacity of 2000 persons for the following outdoor and indoor comfort conditions. Outdoor temperature 34°C, 70% RH Indoor temperature 26 °C DBT, 50% RH, Sensible heat load=480000 K J/ hr Latent hear load =160000 KJ/ hr. The rise in temperature of the air inside the auditorium is limited to 7 °C. About 70% of the room air going to the exhaust is recirculated and mixed with 30% fresh air. The fan is located before all the cooling and heating equipment's and mixed air is passed through the fan. The motor capacity is connected to the fan is 50 K W, assume 80% off the motor efficiency is given to the air passing through the fan. The required air conditioning is achieved first by cooling and dehumidification and then heating the air .The dew point temperature of cooling and humidifier coil is 12°C. Determine the following I) Quantity of air supplied to outdoor conditions in m ³ /hr per person. II) The capacity of the refrigeration system TOR. III) Capacity of heating coil in K W. IV) The bypass factor of the cooling coil.	07
Q.2	(a) Discuss the advantages of dense air refrigeration system over and open air refrigeration system	03
	(b) A rectangular duct of 50 cm X 40 cm size carries 75 m ³ /min of air having density of 1.16 kg/m ³ determine the equivalent diameter of the circular duct if 1) the quantity of air carried in both the cases is same 2) the velocity of air in both the cases is same Assume f= 0.01 for sheet metal, calculate the pressure loss per 100 m length of the duct.	04

- (c) The following data is collected regarding a space to be air conditioned, room sensible heat load 42 KW, room latent heat load 12.5 KW, outdoor condition 36 °C DBT and 26°C WBT, room design condition 24°C DBT and 50% RH. Ventilation of outdoor air is 40 m³/min, assume bypass factor 0.15 determine 1) room apparatus dew point 2) temperature of air leaving the conditioner 3) total quantity of air supply, 4) Temperature of air entering the coil 5) Coil dew point temperature 07
- OR**
- (c) A 20 tons refrigeration load on an evaporator is taken by an ammonia absorption refrigeration machine. The cooling is carried out at -30°C. The refrigerant coming out of the condenser is at 20°C and it leaves the evaporator at saturated condition. Assume the following data 07
- Pressure in the generator 11 bar, Temperature of strong Aqua 70°C, Temperature of weak Aqua 100 °C, heat of one kg of anhydrous ammonia leaving the generator =1930 K J/ kg, concentration of weak Aqua =0.28, Concentration of strong Aqua= 0.34 mean specific heat of aqua solution =4.7KJ / Kg°C, Take the heat of Aqua per kg at 0°C = 4.18 kJ/ kg. heat of absorption is given by $Q_a = 806 - 588 X_w - 5960 X_w^2$. Neglecting the heat loss to the surrounding from the generator, calculate quantity of steam required per hour for heating the strong aqua solution in the generator if the steam is supplied at 5 bar and 0.9 dry and condensate comes out at 130 °C. Neglect the pressure loss in the system.
- Q.3 (a)** Explain the working of refrigeration cycle with two stage compression. What are the advantages over single compression system? 03
- (b)** Enumerate desirable properties of refrigerants. 04
- (c)** With neat sketch explain working of lithium bromide water absorption refrigeration system also enlist major fields of application of this refrigeration system 07
- OR**
- Q.3 (a)** Enumerate features of Compound compression refrigeration system with intercooling. 03
- (b)** Explain the following psychrometric terms: Daltons Law of Partial Pressure, Specific Humidity, Relative humidity, Dew point temperature 04
- (c)** Derive an expression for minimum chilled water temperature which can be used with sensible cooling coil in terms of dry bulb temperature and dew point temperature of the air stream and its relevant thermal resistance. 07
- Q.4 (a)** How selection of sound absorbing material on ducting system is done. 03
- (b)** Explain the significance of following psychrometric processes: 04
- i) Cooling and dehumidification,
 - ii) Cooling and humidification
 - iii) Chemical dehumidification
 - iv) Adiabatic saturation
- (c)** What are the important considerations in the design of air conditioning systems? 07

OR

- Q.4 (a) With neat sketch explain construction and working of capillary tube. **03**
(b) Explain the meaning of the terms: throw, drop, spread, and induction in air distribution system. **04**
(c) Where centrifugal compressor are preferred over reciprocating compressor in refrigeration systems. Describe the advantages and disadvantages of centrifugal over reciprocating compressors. **07**
- Q.5 (a) Explain the following terms related to cooling tower: range, approach, heat load. **03**
(b) Describe interaction between fan and duct and the concept of balance in system. **04**
(c) State the important requirements of an air conditioning duct and the general rules to be followed in the design of ducts **07**
- OR**
- Q.5 (a) Compare central air conditioning system with district air conditioning system **03**
(b) State and explain the importance of fan laws, and use the performance of fans under off-design conditions **04**
(c) Draw neat diagram of constant volume induction system and list out its merits over other systems **07**
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