Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1722103 **Date: 03-06-2013**

Subject Name: Advanced Air Conditioning

Time: 10.30 am – 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 Pychrometric chart and table is permitted**

Q.1 **(a)** With skeleton pychrometric chart, explain summer air conditioning system with ventilation air and cooling coil with bypass factor. On the same chart clearly show Room ADP and Coil ADP. **07**

(b) The following data is available for a departmental store: **07**
Outside air = 150m^3/min, Recirculated air = 450m^3/min,
Outside design condition = 35°C DBT, 29°C WBT,
Room design condition = 26°C DBT, 50% RH, RSHF = 0.77, Coil ADP = 9°C
Calculate (1) Temperature of air entering the coil (2) Temperature of air leaving the coil (3) Coil BF (4) Room ADP (5) capacity of cooling coil

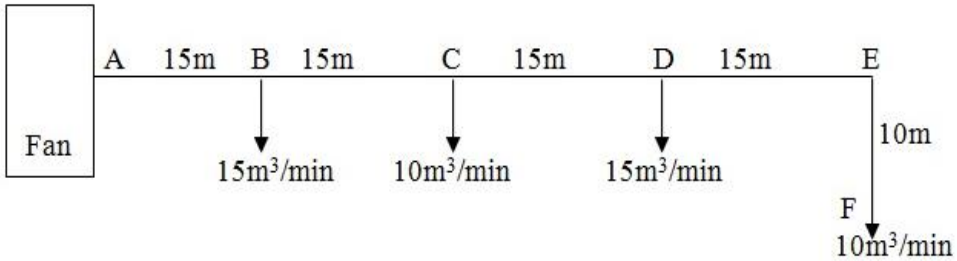
Q.2 **(a)** A cooling tower is supplied with water at a rate of 10,000 kg/min at 46°C. Air entering the bottom of tower is at a rate of 7,000 kg/min. The inlet condition of the air is 30°C DBT and 20°C WBT. The air leaves the top of the tower at 42°C and 90% RH. Find (1) The temperature to which the water is cooled (2) Loss of water/min **07**

(b) How inside design conditions are decided for following applications. **07**
(a) Cold storage (b) Industrial air conditioning (c) Comfort air conditioning

OR

(b) Explain metabolic rate and mechanism of body heat loss. **07**

Q.3 **(a)** Calculate the size of the rectangular duct system (one side = 0.2 m) shown in figure by equal friction method. Assume velocity at point A = 6 m/s **07**



$$\frac{\Delta p_f}{L} = 0.002268 Q_v^{1.852} D_{eq}^{-4.973}$$ mm of H_2O, Q_v is in ómô/sô and D is in ómô

(b) Explain the terms: (a) Draft (b) Blow (c) Induction ratio (d) Drop (e) Spread **07**

OR

Q.3 **(a)** What are the different fan laws? **07**
A fan delivers 50m^3/min of air at a static pressure of 20mm of water (0.2 kPa) and consumes 0.74 kW. If the fan is run at twice this speed. Calculate the capacity, static pressure and power.

	(b)	Select suitable fan type for the following (a) Ventilation fan for a kitchen (b) Fan for an air washer (c) air handling unit of a central air conditioning plant. Justify your selection	**07**
Q.4	**(a)**	Using TETD method calculate the cooling load at 3 pm through a glass window of $10m^2$ area which located in West direction for the month of June when it is (a) un-shaded (b) externally shaded (c) internally shaded with a shade having SC = 0.7 and the convective component of the load for shade = 0.42. Time lag is 4 hr. Take U = 6 and 4.6 W/m^2K for without and with shade, t_o = 45°C, t_i = 25°C. Values of SHGF for North wall are 146, 147, 151, 164 W/m^2 at 12.00 pm, 1.00 pm, 2.00 pm and 3.00 pm respectively. Values of SHGF for West wall are 135, 260, 460, 604 W/m^2 at 12.00 pm, 1.00 pm, 2.00 pm and 3.00 pm respectively.	**07**
	(b)	Explain infiltration with reference to cooling load calculation for comfort air conditioning.	**07**
		OR	
Q.4	**(a)**	Following data is available for a room: Inside design condition 26°C DBT and specific humidity = 11 gm/ kg of d.a., outside design condition 37°C DBT and specific humidity = 16.4 gm/ kg of d.a. Room size = 20m × 20m × 4m, No. of air change /hr =1.5, No. of occupants = 100, Door opening/hr/occupant = 3, Use factor of door = 3, Ventilation requirement = 0.2 m^3/person/min. Calculate (a) total infiltration, (b) ventilation requirement (c) load due to ventilation/infiltration.	**07**
	(b)	Explain various methods of duct design.	**07**
Q.5	**(a)**	Explain factors affecting the selection of type of air conditioning system for particular application. Explain dual duct system.	**07**
	(b)	Compare the characteristics of forward, backward and radial bladed fans.	**07**
		OR	
Q.5	**(a)**	What is noise rating curve? Explain its use with neat sketch. What is RC curve and where is it used?	**07**
	(b)	Explain clean rooms in detail with its specific applications.	**07**

****