

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:**

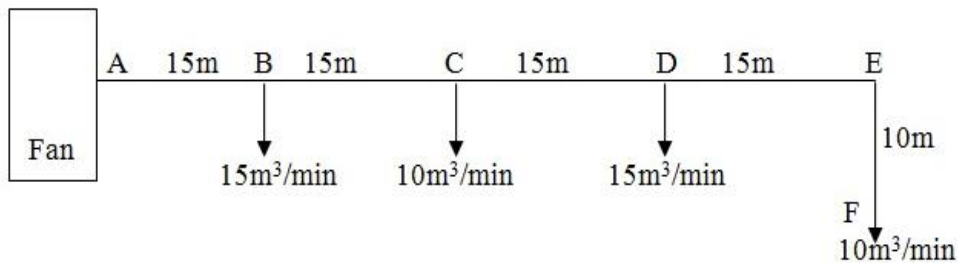
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of Psychrometric chart and table is permitted

- Q.1 (a)** With skeleton psychrometric 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 = 150m³/min, Recirculated air = 450m³/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**



$$\frac{\Delta p_f}{L} = 0.002268 Q_v^{1.852} D_{eq}^{-4.973} \text{ mm of H}_2\text{O, } Q_v \text{ is in } \text{m}^3/\text{s} \text{ and } D \text{ is in } \text{m}$$

- (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 50m³/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 $4.6\text{ W/m}^2\text{K}$ for without and with shade, $t_o = 45^\circ\text{C}$, $t_i = 25^\circ\text{C}$.
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 = $20\text{m} \times 20\text{m} \times 4\text{m}$, No. of air change /hr = 1.5, No. of occupants = 100, Door opening/hr/occupant = 3, Use factor of door = 3, Ventilation requirement = $0.2\text{ m}^3/\text{person}/\text{min}$. 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**
