Air conditioning system design

Design

Contents Introduction This project aims to design the air conditioning system for the function room, computer room, office and restaurant which have required indoor design conditions. In the assignment, the sensible and latent loads of conditioned rooms will be manually calculated, and camel is used to calculate the loads for comparison, also improvement can be made by using camel. After loads estimation, the supply air condition and quantity to different rooms are determined.

The air duct sizes and the installation of the air conditioning system can be designed based on all above. Finally, four competent air conditioners were chosen in this assignment. Load Estimation The load of each room was calculated individually. The coil load was mainly affected by several factors, the wall heat transmission, solar heat through glass, infiltration, internal people and equipment. Here, assumption has been made that the heat transmission through window frames is negligible.

Kitchen Kitchen is located at ground floor, and unconditioned. In this case we assume it has a constant DB temperature of 40th. And it is not necessary to calculate the load of unconditioned area. Restaurant The floor of the restaurant is mm concrete slab covered with carpet above. And a car park underneath, where a possible peak temperature of ICC may occur. The ceiling of the restaurant is mm wood rafters, plaster below, fiberglass insulation between the rafters, topped by mm wooden roof deck and covered by metal decking.

The east wall of the restaurant is mm wide by mm high; plate glass, 2. Mm total width by 2. 4 high; two glazed swing doors each mm by 2. Mm; the

remainder of the wall is brick cavity, plastered inside and thin marble outside. The north wall of the restaurant is mm long by mm high; brick cavity, plastered inside; one 0. 9 m wide ably . Mm high vertically-pivoted metal frame windows and two 5. Mm wide by 2. Mm high fixed plate glass windows fitted with medium color awnings. The west wall of the restaurant is partition area next to kitchen.

It is consist of double brick, plastered both side; mm by mm high, with two 0. Mm by 2. mm swinging doors to kitchen. The south wall is unconditioned area, where a possible peak temperature of 30th may occur; mm long by mm high, brick cavity with plaster on both sides. Transmission Heat Gain from Walls and glass Walls The heat gain through walls is given by: Where the Equivalent Temperature Difference can be obtained from (Table 21) in AIR DADA and the Transmission Coefficient U can be obtained from (Table 24) and (Table 25) AIR DADA.

The Area of the east wall of ground floor is given by The temperature difference in summer and winter is given by: Then the transmission heat gain from west wall of the restaurant is given by: The Area of the north wall of ground floor is given by Then the transmission heat gain from north wall of the restaurant is given by: The area of west wall of the restaurant is given by: The area of the south wall of the restaurant is given by:

The temperature difference is given by: Then the transmission heat gain from south wall of the restaurant is given by: The area of the floor of the restaurant is given by The temperature difference in summer is given by (assuming car park area has a constant peak temperature of 32 degree

slices): Then the transmission heat gain from floor of restaurant is given by: The area of the roof of the restaurant is given by The temperature difference in winter (no temperature difference in summer) is given by: Then the transmission heat gain from roof of computer room is given by: The total transmission of wall: Glass

The heat gain from glass is given by: Consider the glass as single vertical glass, whose transmission coefficient is given by (Table 36) as 5. IOW/Mac in summer and 6. IOW/Mac in winter. Consider the outdoor condition as 33. ICC DB in summer and 2. ICC DB in winter. Assume the condition of unconditioned area as their maximum temperature ICC in summer and ICC in winter (except the kitchen with ICC). 1 . Transmission heat gain from glass in summer The glass heat gain from kitchen is given by The glass heat gain from outdoor is given by The total glass heat gain of the restaurant in summer is given by:

Transmission heat gain from glass in winter And from calculations above, the total wall heat transmission is the accumulation of heat transmission of six areas and all glass in the room. Solar heat through glass The Actual Cooling Load, Solar Heat Gain through Window: W= (Area) x (Peak Solar Gain) x (Correction Factors) x (Storage Load Factor) x (Shade Factor) Here, to determine the storage load factor, the mass per unit area need to be calculated first. The area of the east wall is calculated before. The wall type is brick cavity, plastered inside. The Mass per unit area is 423+21= 444 keg/mm given by (Table 4) .

The area of the north wall is calculated before. The wall type is brick cavity, plastered inside. The Mass per unit area is 423+21= 444 keg/mm given by (Table 24). The area of west wall of the restaurant is calculated before. The wall type is brick 24). The area of the south wall of the restaurant is calculated before. The wall type is double brick, plastered both sides The Mass per unit area is 101 given by (Table 26). The area of the floor of the restaurant calculated before. The type is mm concrete slab covered with carpet above. The Mass per unit area is keg/mm given by (Table 27).

The area of the roof of the restaurant is calculated before. The type is floor ceiling, carpet and underlay floors The Mass per unit area is keg/mm given by (Table 33). Total mass per square meter of floor area: -763. Kvass For East window Plate glass The peak solar gain is given by (Table 14), the glass factor is given in (Table 18) or (Table 15), the storage load factor is given by (table 10). For East door two glazed swing doors MM XX. 29X420xo. Ox. 94= 1211. IOW For North windows, Vertically-pivoted metal frame windows, 1/0. 85 is the solar gain correction given by (Table 5): . Ex..

XIX/o. Ox. 53= 195. IOW Fixed plate glass windows fitted with medium color awnings, 0. 24 is the over-all factor for solar heat gain through glass given by (Table 18): Actual cooling load: W Infiltration First, the infiltration factor need be determined, by using (table 44), it can be calculated as: For restaurant, infiltration factor SSL/2+1/2+O+O+O+O= 1 chi/h And for restaurant the room value is xix= 315 mm In summer The heat exchange caused by infiltration can be calculated referred from the equation in (unit 3 example 1). And both the latent heat and sensible heat need be calculated.

Sensible heat Latent heat In winter Using the same method used in summer. Sensible heat Internal load Occupancy: Space for a total of 50 people seated at table and 5 employees in the conditioned part of the restaurant. Peak occupancy at 1 pm (Lunch period). The 50 customers need apply an extra 10 watts each for hot meal. Equipment: Two gas- heated coffee urns, 11 liter capacity. But the data of gas-heated coffee urn cannot be found in references. Here, consider it as an electrical coffee urn. Light: From (BOBCATS Table J. 6), the lamp power density is IOW/mm.