University of Technology

Engineering Department of Building and Construction

Final Exam-First attempt 2015-2016

Subject: Buildingp services **Year: Fourth**

Division: Construction Engineering and Management **Time: 180min.**

Examiner: Assist prof.Haider Alwash **Date : / 5 /2016**

Answer FIVE Questions Only

Note: - All tables must be return with exam. papers

Q1):- According to the data shown in fig. (1).Calculate the max. number of person in the room and ventilation rate per person and the capacity of air conditioner. (20Mark)

Q2):-Calculate the coefficient of transmission (U) of masonry wall and the rate of heat loss and temperature drop through the section of the wall and the position of dew point. The outdoor temperature (zero) F, indoor temperature (70) F, the construction of the wall are:-

Construction	Resistance(R)
Rsi	0.68
Gypsum lath (3/4in)	0.32
Brick(4in)	0.39
Air space	0.97
Concrete block	1.11
Cement mortar	0.1
Rso	0.17

(20Mark)

Q3) :- A)1- Design the cable required to feed (2Kw load, 3Kw load (Pf=0.7 lead), 50Kw load (Pf=0.8 lag), 2hp load (Pf=0.7 lead)), if the nominal voltage (220V, single phase) and the distance between circuit breaker and main board is (30m) and diversity factor (0.529),the cable is clipped direct to surface.

2) Show by sketch the connection of the cable to the main board and circuit breaker.

3) Calculate the overall power factor. (10Mark)

B) Use zonal cavity calculation and design the ceiling lightings for large business office (100x60x8) ft ,use luminaries type (10),(125 foot candles),reflectance of ceiling 80%,floor 30%,wall 30%, working plane (36) in., Maintenance factor (0.67), Correction factor (1.08). (10Mark)

Q4):- Design the Storm Water Drain System for the building shown in fig. (2), the local rainfall (4"per hr.) and the slope of the horizontal storm drain (1/4"). (20Mark)

5): Find the main pressure piped required to fill the water tank at a height of (60)ft ,and a capacity of (12) cubic meter , during the two –hours period ,if you know that the diameter of feeder pipe (2)inch, and the length from feeding point to the tank (110)ft ,the losses of pressure gauge equal (10)ft,and minor losses equal (10%) of the pipe length . (20Mark)

Q6) :- A) Use the Equivalent pipe method and Design the cold water pipes shown in figure (3). (10Mark)

B) Design the Sprinkler system for the factory of (24x50) m^2, ordinary hazard with standard arrangement and center with central feed. (10Mark)

Good Luck

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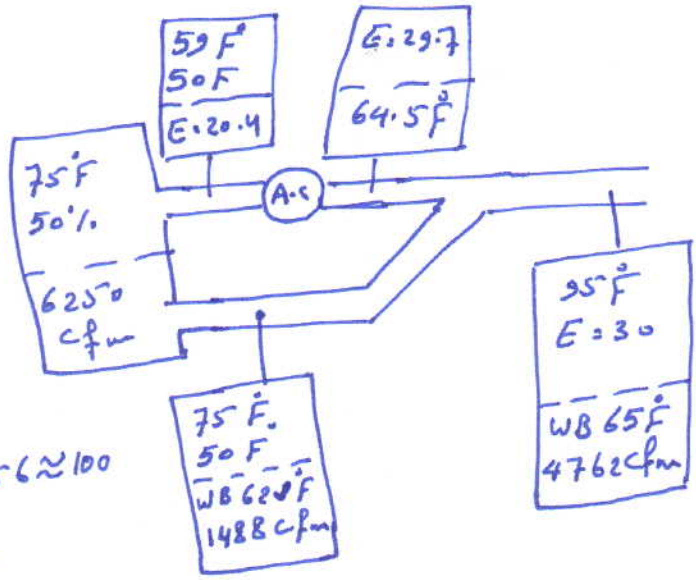


Q1)

35 °C → 95 °F

23.88 → 75 °F

15 °C → 59 °F

$SHR = \frac{RSH}{RSH + RLH}$

∴ RLH = 29870 Btuh

No of person = $\frac{29870}{300} = 99.56 \approx 100$

$Q_3 = \frac{RSH}{75 - 59} = 6250$ cfm

Use chart

E = 20.4 Btu/lb

WBT = 65 °F out door

WBT = 62.9 °F Return air

WBT = 64.5 °F mix. air

heat to be removed by A-C = 60 * 0.075 * 6250 (29.7 - 20.4)
= 261562.5 Btuh ≈ 22 ton.

$WBT_{mix} = 64.5 = \frac{Q_2 * 62.9 + (6250 - Q_2) * 65}{6250}$

∴ Q_2 = 1488 cfm ∴ Q_1 = 6250 - 1488 = 4762 cfm

cfm/person = $\frac{4762}{100}$ = 47.62 cfm.

Q2

$$U = \frac{1}{\Sigma R} = \frac{1}{\Sigma R = 3.74} = 0.2673$$

$$q = UA\Delta T = 0.2673 * 1m^2 * 70 = 18.716 \text{ Btu/h}$$

$\Delta T_1 = 12.7268$ $\therefore T_2 = 57.273$

$\Delta T_2 = 5.989$ $\therefore T_3 = 51.284$

$\Delta T_3 = 7.299$ $\therefore T_4 = 43.9852$

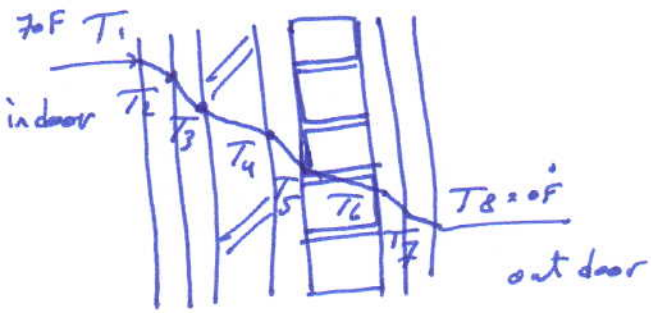
$\Delta T_4 = 18.154$ $\therefore T_5 = 25^{-}.931$

$\Delta T_5 = 20.774$ $\therefore T_6 = \underline{5.05^{-}}$

$\Delta T_6 = 1.8716$ $\therefore T_7 = 3.185^{-}$

$\Delta T_7 = 3.1818$ $\therefore T_8 = 0^{\circ}F$

dew point between $T_6 - T_7$



Q3 A) 2000w $I = \frac{\text{power}}{V \cos\theta}$

$2000/220 = 9.09$ amp

3000 w $3000/220*0.7 = 19.48$ amp

50 000 w $50\,000/220*0.8 = 284.09$ amp

$2hp * 746 = 1492w$ $1492/220*0.7 = 9.688$ amp

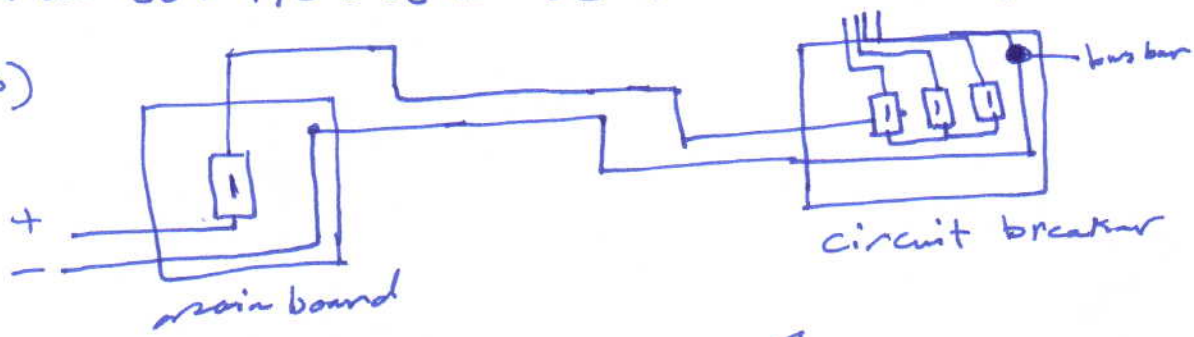
$I = 322.35 * 0.529 = 170.523$ amp $\quad I_t = 322.35^{-}$ amp

Use table 18

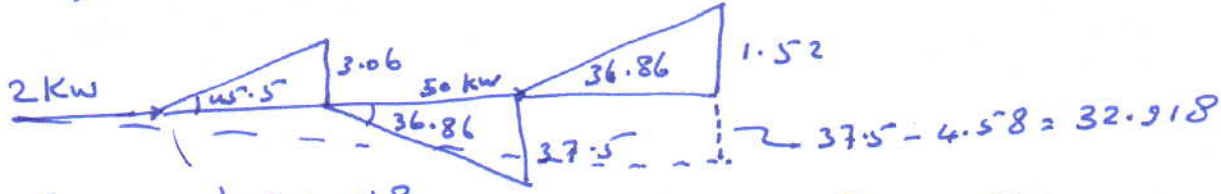
$50mm^2 \longrightarrow$ Vol. drop $= 0.93$ mv / amp / meter

$V.d = 30 * 170.5^{-}23 * 0.93 \times 10^{-3} = 4.757 < 5.5$ o.k

B)



C)



$\theta = \tan^{-1}\frac{32.918}{56.492} = 0.582 \therefore \cos\theta = 0.999$

Q3 B)

$h_{cc} = 0$ $\quad R_c = 80\%$ $\quad CCR = 0$

$h_{rc} = 5'$ $\quad R_w = 30\%$ $\quad RCR = 0.7$

$h_{fc} = 3'$ $\quad R_f = 30\%$ $\quad FCR = 0.4$

Use table 28-7

ρ_{cc} 80% $\quad \rho_{fc} = 27\%$ $\quad \rho_w = 30\%$

Use table 28-9 fixture type 10

$C_u = 0.485 * 1.08 \simeq 0.523$

$$\text{area/luminar} = \frac{4 * 3250 * 0.523 * 0.67}{125} = 40 \text{ s.f}$$

$$\text{No. of luminars} = \frac{100 * 60}{40} = 150$$

$$\text{Max } \frac{S}{MH} = 0.7 \quad \therefore S = 0.7 * 5' = 4.5' \quad \text{not O.K}$$

Q4

Use table (5.1) size of leaders

area	Dia. of leaders
400 s.f	2"
6000 s.f	5"
8000 s.f	5"

Use table (5-2) size of horizontal storm drain $\frac{1}{4}$" slope

area s.f	Dia.
4000	5"
4400	5"
12400	8"
18400	10"
26400	10" To storm sewer

Q5) $Q = \frac{Vol}{Time} = \frac{12 m^3}{120 min} * \frac{1000 l}{4.5 gal} = 22.2$ gpm.

Use fig. 2-22 $\quad \Phi$ 22.2 gpm, Φ 2" $\rightarrow i = 0.8$ Psi/100ft

$$i = 0.8 * \frac{2.3}{100} = 0.0184 \text{ ft/ft} = \frac{P - (60' - 10')}{110' * 1.10}$$

$\therefore P = 72.22'$ main pressure Piped.

Q6 A)

Pipe	fixture	table(1)	table 2	Dia
D D''	5 Ks + 5 sh	$1\frac{1}{2}$ + $1\frac{1}{2}$	34.8	2"
D D'	5 Wc + 3 U + 5 L	$1\frac{1}{4}$ + 1 + 1	23.3	2"
D C	(DD'' + DD')		58.1	$2\frac{1}{2}$"
CC'	3 Wc + 3 U + 3 L	1" + 1" + 3/4"	15.3	$1\frac{1}{2}$"
CC''	3 Ks + 3 sh	$1\frac{1}{4}$" + $1\frac{1}{4}$"	21.8	2"
C B	(DD'' + DD' + CC' + CC'')		95.2	3"
B B'	3 Wc + 3 U + 3 L	1" + 1" + 3/4"	15.3	$1\frac{1}{2}$"
B B''	3 Ks + 3 sh	$1\frac{1}{4}$" + $1\frac{1}{4}$"	21.8	2"
B A	D'' + DD' + CC'' + CC' + BB' + BB'')		132.2	$3\frac{1}{4}$"

B) Use table 1 & 2 for sprinklers

area $50 * 24 = 1200 m^2$

let $a = 10 m^2$

no of sprinklers $= \frac{1200}{10} = 120$

let $D = 4 m$

no of pipes $\frac{24}{4} = 6$

no of sprinkler/pipe $= \frac{120}{6} = 20$

$S = \frac{a}{D} = \frac{10}{4} = 2.5 m$