University Of Technology

Building and Construction Eng. Dept.

Final Exam-First attempt–2016/2017

Branch : Building & construction Management Engineering. — **4th Class**

subject : Building Services — **Time : 3 hr.**

Examiner: building services committee — **Date : 31- 5-2017**

Answer four questions only

Q1. Design the hot water system for the building shown in Fig (1) if the head and height of the fixture equal to 5psi and equivalent length of the losses due to friction in valves and joints =25% of the pipe length. Neglect the losses in heater and assume heater height =5 ft. (25mark)

Q2. Design the sprinkler system for the factory of (50*24) m^2, ordinary hazard with standard arrangement center with center feed. (25mark)

Q3. An office with dimensions (6m*5m*3m), 2windows of (3*2)m^2, one door of (1.5*2)m^2 as shown in Fig (2), 10 person with total heat for each =132W, 16 fluorescent lamps of 50W, air change rate ACH=2, outdoor conditions are 10c^0 db, 6 c^0wb, where the indoor conditions are 25 c^0 db, 50% RH. The adjoining office conditions are 26 c^0 and 50% RH. Calculate total heat gain due to:

1. Walls, windows, door
2. Lamps
3. Occupants
4. Ventilation

(Heat transfer factor: wall=1.6W/m^2K, glass= 3.2W/m^2K, wood=1.8W/m^2K). (25mark)

Q4. If the electrical loads in building are 2kw load , 3kw (Pf= 0.7lead), 50 kw load (Pf=0.8 lag), 2hp load (Pf=0.7lead), 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 .

1. Design the cable required to feed these loads.
2. Calculate the overall power factor. (25mark)

Q5.A. show with sketch:

1. The voltage system types .
2. Air conditioning in summer and winter. (10mark)

B. show the connections of :

1. Single phase 220V motor
2. 3 phase 380V motor.
3. Heater single phase (380V).
4. air condition (220/380) V 3phase. (15mark)

grp 1,2,3,4

3L, 3Sh, 3S.S, 3WC (Flash Tank)

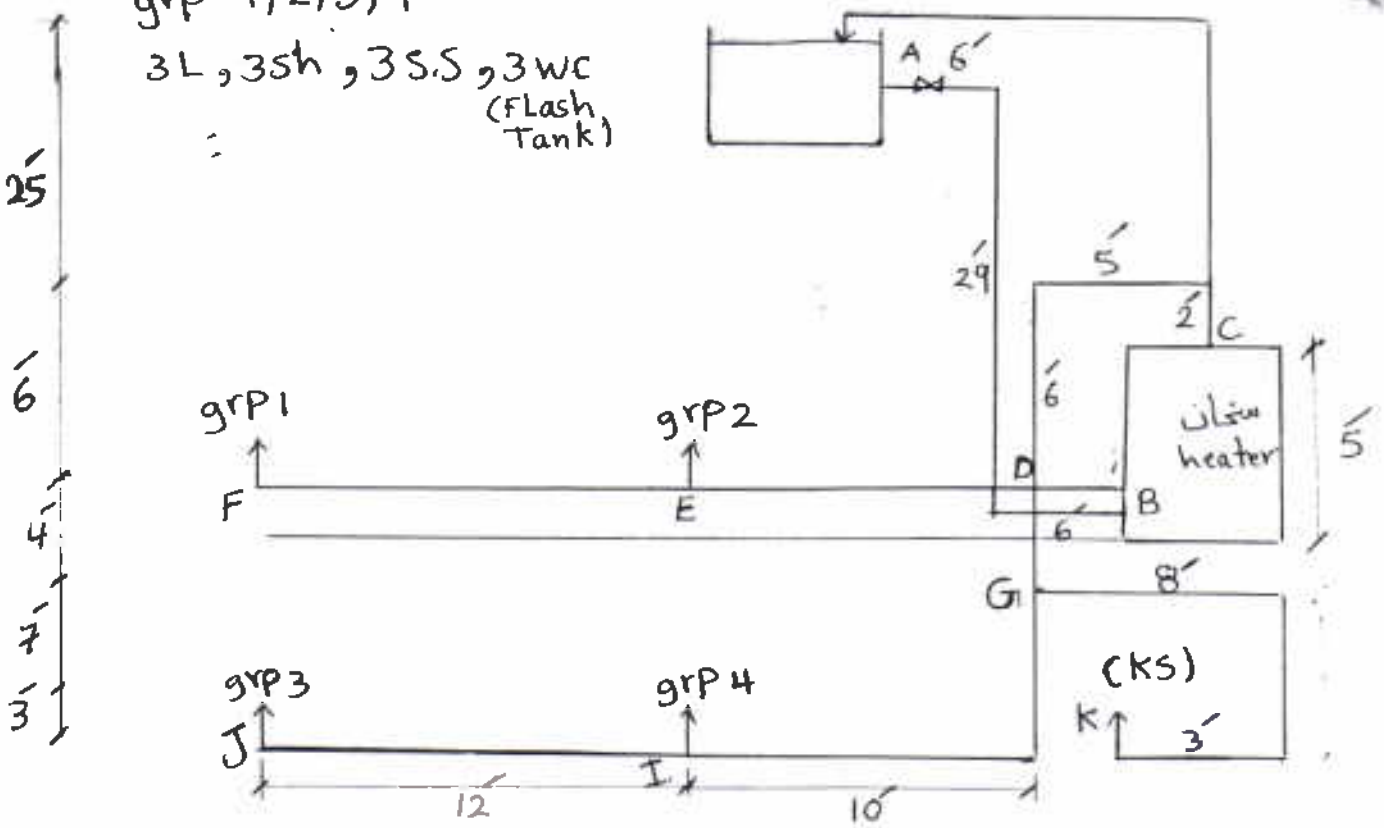

Fig (1)

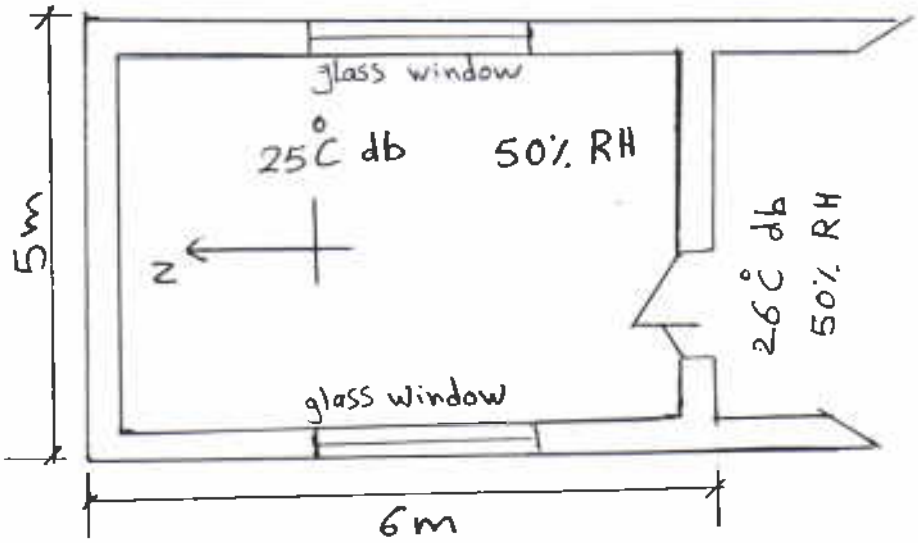

Fig (2)

خدمات بناء / رابع ادارة مشاريع 2016-2017

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Typical Solutions

building Services

4th class

Q1 solu:-

$$i_{ACDF} = \frac{elv.A - (elev F + \text{ارتفاع التركيبة} + \text{ضغط التركيبة})}{(l_d\ A \to F)(1 + \text{ضياعات الملحقات})}$$

$$i_{ACDF} = \frac{[45' * 0.434 \frac{psi}{ft} - (14' * 0.434 + 5\,psi)]}{(6' + 29' + 6' + 5' + 2' + 5' + 6' + 10' + 12')(1.25)}$$

$$i_{ACDF} = 0.0834 \frac{psi}{ft}$$

$$= 0.0834 \frac{psi}{ft} \times 100 ft = 8.34$$

fixture	unite
L	$2 \times \frac{3}{4} = 1.5$
sh	$4 \times \frac{3}{4} = 3$
S.S	$3 \times \frac{3}{4} = 2.25$
k.s	$4 * \frac{3}{4} = 3$

pipe	F.U	Q fig(8)	dia fig(4)
JI	20.25	15	$1\frac{1}{4}$"
IG	40.5	25	$1\frac{1}{2}$"
KG	3	3	3/4"
GD	43.5	26	$1\frac{1}{2}$"
FE	20.25	15	$1\frac{1}{4}$"
ED	40.5	25	$1\frac{1}{2}$
DC	84	40	2"
ABC	84	40	2"

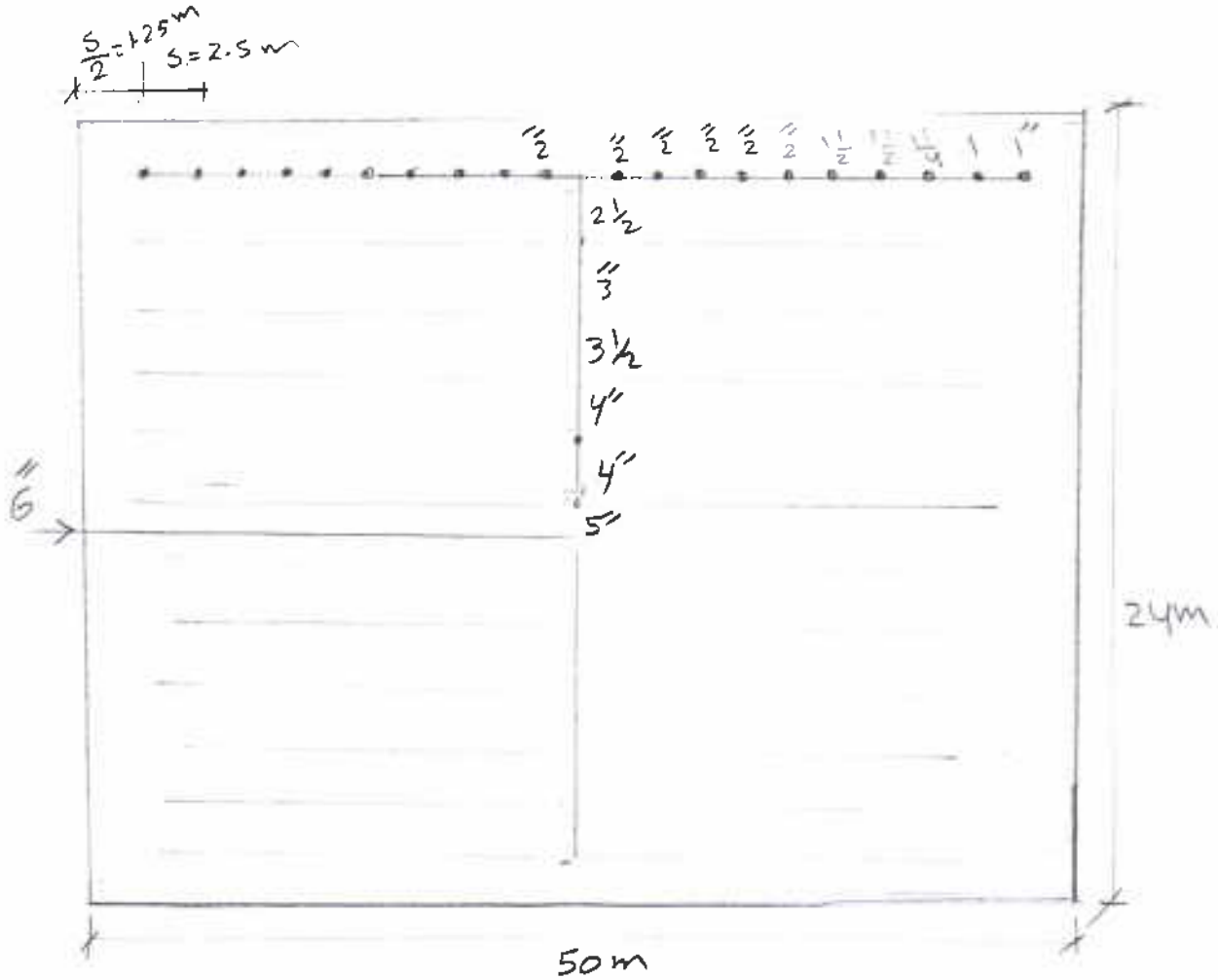
Q2. $A = 50 \times 24 = 1200$ ordinary hazard

$S = 2.5$ $D =$ $a = 5$

$$\frac{A}{a} = \frac{1200}{5} = 240 \text{ sprinkler}$$

$$\frac{B}{D} = \frac{24}{2} = 12 \text{ pipe}$$

$$\text{no. of sprinkler/pipe} = \frac{240}{12} = 20 \text{ sprinkler}$$



Q_3.

الإتجاه	A m^2	U W/m^2K	$\Delta T°$	Q_w W	Q_w W
الحوائط					
الشمال	15	1.6	-15		-360
الشرق	12	1.6	-15		-288
الجنوب	12	1.6	+7		19.2
الغرب	12	1.6	-15		-288
الشبابيك				-916.8	
الشرق	6	3.2	-15		-288
الغرب	6	3.2	-15		-288
				-576	
الابواب الجنوب	3	1.8	-15	181	

$Q_w = -1573.0$

الكسب الحراري نتيجة الاشخاص Q_p

$Q_p = N \times q_p$

$= 10 \times 132 = 1320 W = 1.320 kW$

الكسب الحراري نتيجة الاضاءة Q_L

$Q_L = N \times F \times P$

$= 16 \times 1.25 \times 50 = 1000 W = 1 kW$

الكسب الحراري نتيجة التهوية Q_v

$V = 6 \times 5 \times 3 = 90 m^3$ ← حجم الغرفة

$v_o = 0.806 \ m^3/kg$ ← الحرارية النوعية

$h_R = 50.5 \ kJ/kg$ طاقة الهواء الداخلية والخارجية

$h_o = 20 \ kJ/kg$

معدل سريان التهوية $\dot{m}$

$\dot{m} = \frac{V}{3600 v_o} = \frac{90 \times 2}{3600 \times 0.806} = 0.061 \ kg/s$

$Q_v = m(h_o - h_r)$ حمل التهوية

$= 0.0.1(20 - 50.5) = -1.892 \ kW$

$Q_t = Q_w + Q_p + Q_L + Q_v = \quad kW$

Q4.

① Power watt

$$I = \frac{\text{Power}}{V \cos\theta}$$

2000W — 2000/220 = 9.09 amp

3000W — 3000/220 × 0.7 = 19.48 amp

50000W — 50000/220 × 0.8 = 284.09 amp

2hp × 746 = 1492W — 1492/220 × 0.7 = 9.688 amp

$I_t = 322.35$ amp

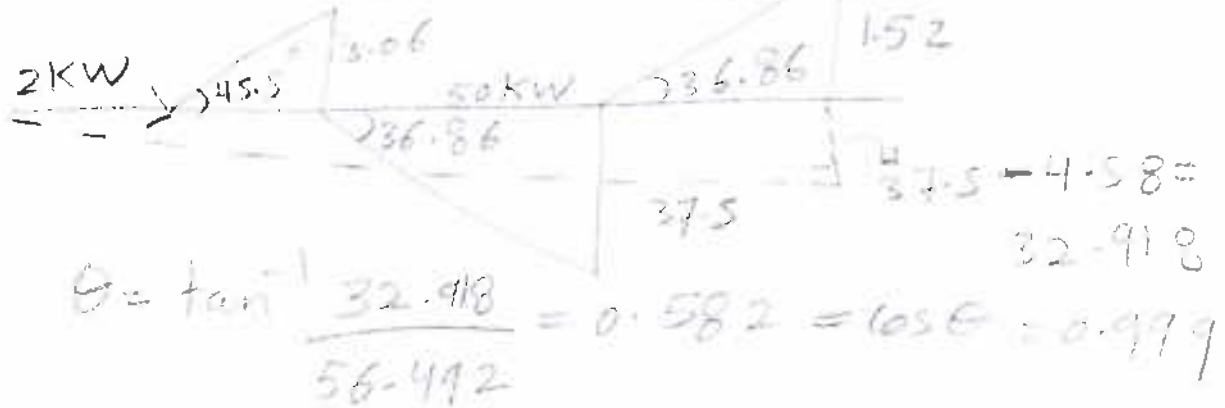
$I = 322.35 \times 0.529 = 170.523$ amp

use table 13

50 mm² → Vol. drop = 0.93 mV/amp/meter

$V.d = 30 \times 170.523 \times 0.93 \times 10^{-3} = 4.757 < 5$ ok

② $IV = \frac{3}{0.7}$



$\theta = \tan^{-1} \frac{32.918}{56.492} = 0.582 = \cos\theta = 0.919$

Q5

① voltage system

① 220V - single-phase-2wire

② 220/380V 3phase-4wire

② air conditioning in summer and winter as fig( )

③