Kafr El-Sheikh University
Faculty of Engineering
Civil Engineering Department
Third Year Civil, 1st term

Full mark: 75

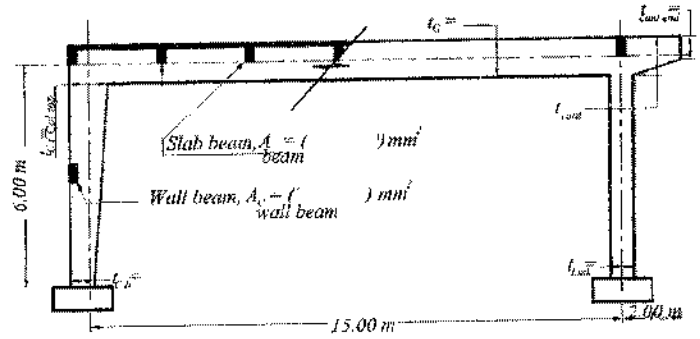
Reinforced Concrete 2
Final Exam
Date: June, 21th , 2021
Time: 4.00 Hours

- **Answer all the following question.**
- **It is allowed to use Egyptian code-design aids.** يسمح باستخدام جداول و مساعدات التصميم
- **Any missing date may be reasonably assumed.**
- **Grade of used steel is 350/520 & 240/350 for steel and stirrups. The used f_{cu} is $35\ N/mm^2$**
- **This course satisfy LOS of A4, B1and B2**

Question No. 1 (54%), select the correct answer :-

For the frame system

The ***empirical dims*** employed for RC frame with can be used for *hall covering* span length of 15.00m



1- Generally the RC frame is preferable cover a hall with span up to [a- 10m b- 14m c- 22m d- no right answer]

2 – t_G = (---) | $a - 1.5\sim1.6m$ $b - 1.25\sim0.93m$ $C - 1.80\sim2.00m$ $d - no\ right\ answer$]

3 – b_G = *the best width can be*(---)mm [$a - 200mm$ $b - 400mm$ $C - 1000mm$ $d - no\ right\ answer$]

4 – $t_{Col\,t}$ = (---) * t_G = [$a - 1 * t_G$ $b - 3 * t_G$ $C - 4 * t_G$ $d - no\ right\ answer$]

5 – $t_{Col\,b}$ = (---) * $t_{col\,t}$ = [$a - 1 * t_{col\,t}$ $b - 2 * t_{col\,t}$ $C - 0.5 * t_{col\,t}$ $d - no\ right\ answer$]

6 – t_{Cant} = (---) * t_G = [$a - 1 * t_G$ $b - 3 * t_G$ $C - 4 * t_G$ $d - no\ right\ answer$]

7 – $t_{Cant\,end}$ = (---) * t_{Cant} = [$a - 1 * t_{Cant}$ $b - 2 * t_{Cant}$ $C - 0.5 * t_{Cant}$ $d - no\ right\ answer$]

8 – t_{link} = (---) * t_G = [$a - 1 * t_G$ $b - 2 * t_{Cant}$ $C - 0.5 * t_G$ $d - no\ right\ answer$]

– $A_{c\,beam}$ = (---) mm^2 = [$a - 250 * 600$ $b - 500 * 900$ $C - 600 * 900$ $d - no\ right\ answer$]

10 – *(by asuming that slab is used for covering, spacing between beam is preferable to be)* = (---)m

[$a - 2\sim3m$ $b - 4\sim6m$ $C - 7\sim8m$ $d - no\ right\ answer$]

For loads:

11- By knowing that the slab thickness is *120 mm, F.C=1.50 kN/m², L.L=3.00 kN/m²*

w_{slu} = (---) kN/m^2 = [$a - 4$ $b - 11.25$ $C - 15$ $d - no\ right\ answer$]

12- By knowing that the girder for the RC frame *t_G=1.3 m, t_s= 120 mm, b_G=0.40m*

w_{lu} (---) kN/m = [$a - 9$ $b - 10$ $C - 16.52$ $d - no\ right\ answer$]

Design of real hinged base

13 A_{plate} (–) *the best answer* [$a - b_{frame} * \frac{t_{Col\,b}}{1}$ $b - b_{frame} * \frac{t_{Col\,b}}{2}$ $C - b_{frame} * \frac{t_{Col\,b}}{3}$ $d - No\ Ans.$]

14 Plate thickness is preferable to be (--)[a- 20mm b- 30mm c- 40mm d- no right answer]

By knowing that A_{plate} = 400 x 300 mm² $V_u = 1105\ kN$ $H_u = 259\ kN$ $A_c = 400x800\ mm^2$

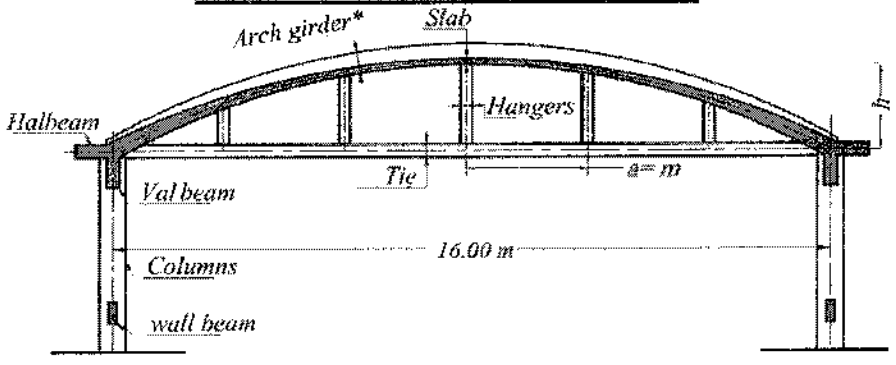
15 The bearing stress is (--) N/mm² [a- 3 b- 9.208 c- 15 d- 30]

16- The allowable bearing is f_b (--) [$a-0.15*f_{cu}\sqrt{\frac{t}{t'}}$ $b-0.50*f_{cu}\sqrt{\frac{t}{t'}}$ $c-0.55*f_{cu}\sqrt{\frac{t}{t'}}$ $d-0.67*f_{cu}\sqrt{\frac{t}{t'}}$]

17 – *for vertical bars used for shear* $A_s = \frac{H_u}{(--)*(f_y/\gamma_s)}$ [$a-0.5$ $b-0.8$ $C-1.0$ $d-1.1$]

18-The splitting force $F_{splitting}$= (--)kN [a- 276 b-426 c-123 d- No answer]

For the Arch slab covering system

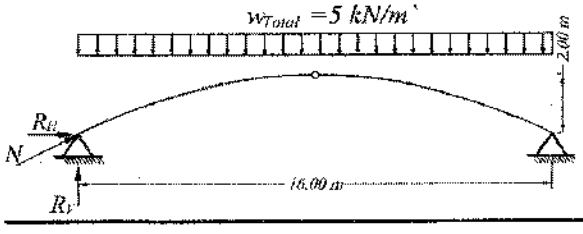


empirical dims.

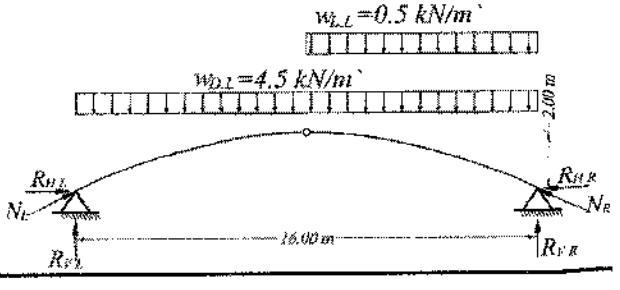
19 – h = (---) m [a- 2.66~2 b-3~4 c-4~5 d- No answer]
20 – t_{Slop} = (---)mm [a-(60~80) b-(80~90) c-(100~140) d- No answer]
21 – t_{sbot} = (---)mm [a-(200) b-(220-) c-(250) d- No answer]
22 – $A_{c\ hanger}$ = (---) mm^2 *is preferable to be* [a-(100x100) b-(250x250) c-(500x500) d- No answer]
23 – $S_{bet\ Hanger}$ = (---) m [a-(1) b-(2.67) c-(4) d- (5.67)]
24 – A_{Tie} = (---) mm^2 *is preferable to be* [a-(150X150) b-(300x300) c-(1000x1000) d- No answer]
25 – $t_{Column} = \frac{H}{(--)}$ = [a-(6~8) b-(8~9) c-(10~12) d- No answer]

Loading and structural analysis and design:-

1st case



2nd case



For the first case

26-R_v= (--) kN = [a-(40) b-(50) c-(60) d- No answer]
27-R_H= (--) kN = [a-(60) b-(70) c-(80) d- No answer]
28- N= (--) kN = [a-(60) b-(89.5) c-(80) d- No answer]
29- For checking the top arch capacity [a-(safe section) b-(un-safe section) c-(huge steel is required) d- No answer]
30- $A_{s\,min}$ is (--%) *b*t [a-(0.6) b-(0.8) c-(1) d- No answer]

For the second case

31- M_{max}=(--) kN.m [a-(1) b-(2) c-(3) d- No answer]
32-$R_{H\,L} = R_{H\,R}$ = (---) kN [a-(50) b-(76) c-(80) d- No answer]
33-R_{VR} = (---) kN [$a-\frac{3*W_{L.L}*L}{8}+\frac{W_{D.L}*L}{2}$ $b-100$ $c-300$ $d-500$]
34- $N_{quarter}$ = (---) kN [$a-20$ $b-50$ $c-78$ $d-97$]

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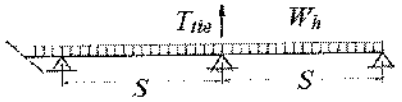
For horizontal beam, vertical beam and hangers



35- S= (--) [a-space between Ties b-Space between stiffeners c- space between hangers d-(a&b)]
36- W_h= (--) is the total horizontal force coming from [a-1st case b- second case c-(a&b) d-(no ansewr)]
37 – The higher tie force T_{tie} = (--) *W_h*S [a- 0.50 b-0.80 c- 1.10 d-no answer]
38- In most cases, the horizontal beam is supported by [a-Vertical beam b-Tie c-Columns d- Stiffeners]

For vertical beam and hangers

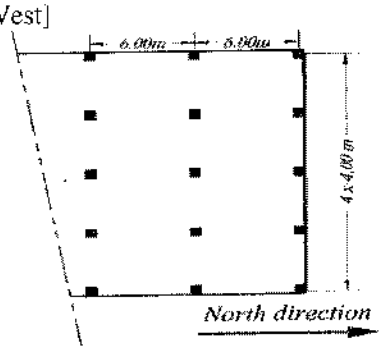
39- For this question, by assuming that h_{hanger}= 2.00 m, $A_{c\ hanger}$ =0.25*0.25 mm^2, $S_{between\ hanger}$ =2.67m, A_{tie}=0.3*0.3
$T_{u\ hanger}$ = (--) kN [a-5.70 kN b-12.70 kN c-40.20 kN d- No Ans.]
40- Generally, the arch slab can be used for covering with short span, L_{sh} [a-25m b-30m c-40m d- 50m]

For the saw-tooth roof structure

Empirical dims.

41- The fact that the saw-tooth mouth is opened to the , [a-North b-south c-east d- West]

For the shown area for a manufactory,

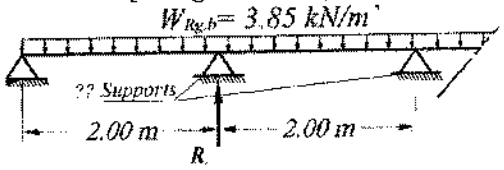


The major Dims. can be assumed as follows
42- slab thickness, t_s= (--)mm [a-50mm b-100mm c-280mm d- No Ans.]
43- A_c secondary beam = (--)mm^2 [a-200x500 b-200x900 c-200x1200 d- No Ans.]
44- A_c ridge beam = (--)mm^2 [a-200x300 b-200x700 c-200x900 d- No Ans.]
45- A_c Y-beam = (--)mm^2 [a-300x300 b-300x600 c-200x900 d- No Ans.]
46- A_c post = (--)mm^2 [a-100x100 b-200x200 c-900x900 d- No Ans.]
47- $S_{bet\ post}$ = (--) m [a-2~3 b-4~6 c-6~7 d- No Ans.]

Load, and structural system

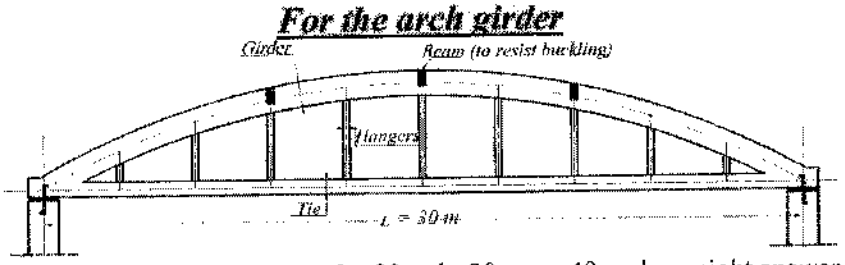
H post = 2.00 m L.L=1.00 kN/m^2, F.C=1.00 kN/m^2, f_{cu}=35 N/mm^2 and f_y=350 N/mm^2

48- by knowing that w_{su}=1.4*D+1.6*L.L, w_{su} =(--) kN/m^2 [a-1.23 b-2.87 c-6.77 d- No Ans.]
49- The slab is supported by(--) [a- secondary beam b- ridge beam c- Y-beam d- No Ans.]
50- The Maximum moment for slab $M_u = \frac{w_{su} * Space^2_{between\ Scondry\ beam}}{(---)}$ [a- 8 b- 10 c-24 d-No Ans.]
51- The inclined secondary beam is supported over [a-ridge-beam & post b- Ridge &Y-beam c-Y-beam & post d-No.Ans]



52- The previous beam is ridge beam, it is supported over (--)[a- Sc beam b- Y-beam c- posts d-major columns]

For the arch girder



53- Generally the RC Arch girder can resist span up to [a- 20m b- 30m c- 40m d- no right answer]

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Empirical Dims.

54- $h = (---)m$ [a-8 b-7 c-4 d- 2.]

55 – $t_G = (---)\ m$ [a-1 b-1.3 c-1.4 d- No Ans.]

56 – Ac hanger = (---)mm2 [a – 100x100 b – 250x250 c – 900x900 d – No Ans.]

57 – $t_{Tie} = (---)$m = [a-0.6 b-0.9 c-1.00 d- No Ans.]

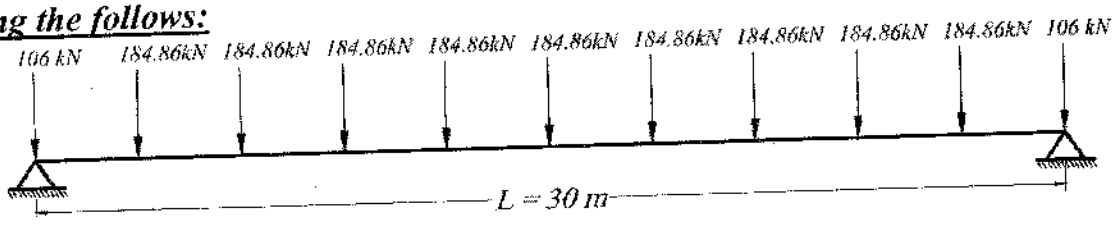
58 – b_{Tie} *is preferable to* (---) b_G *[a- > b-< c= . d- there is condition]*

59 – $t_{column} = \dfrac{H}{(---)\ (hinge\ case\ at\ top)}$ = [a – 5~8 b – 7~8 c – 9~10 d – No Ans.]

60 $S_{between\ arch}$ = *is prefer to be* (---) m = [a – 2~3 b – 5~6 C – 7~8 d – No Ans.]

Loads and reactions

By knowing the follows:



61- W_{eq}= (--) kN/m` [a- 30.40 b- 55.50 c-60.98 d- No ans]

62 – $R_{column} = (---)\ kN$ [a- 309.60 b- 503.40 c-937.87 d- No ans]

63 – $M_{u\ simple} = (---)\ kN.m$ [a- 4899.60 b- 6243.75 c-9938.80 d- No ans]

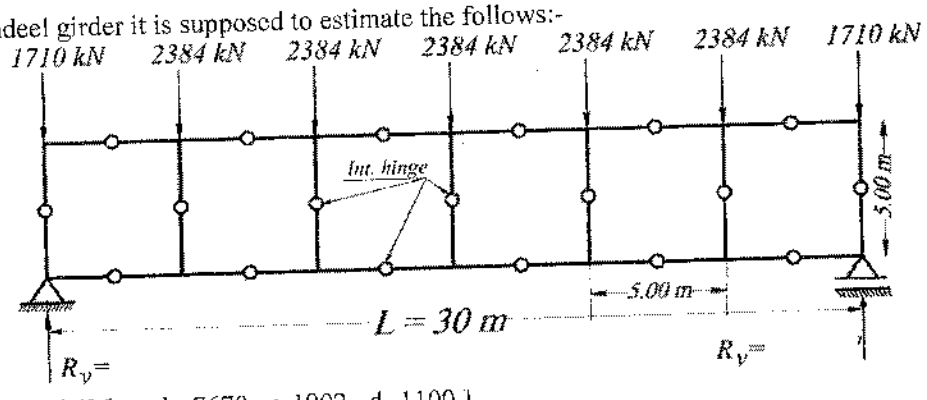
64 – $C = T = (---) * \frac{M_{u\ simple}}{h}$ [a- 0.95 b- 0.05 c-8 d- 1.10]

65 – $M_{u\ arch} = (---) * M_{u\ simple} = kN.m$ [a- 0.95 b- 0.05 c-8 d- 1.10]

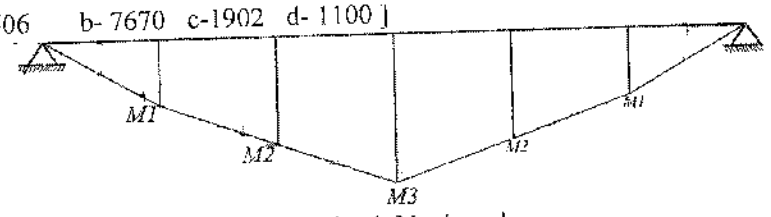
For the Vierendeel girder

66- Generally the Vierendeel girder can resist span up to [a- 20m b- 30m c- 40m d- 60m]

For the shown Vierendeel girder it is supposed to estimate the follows:-



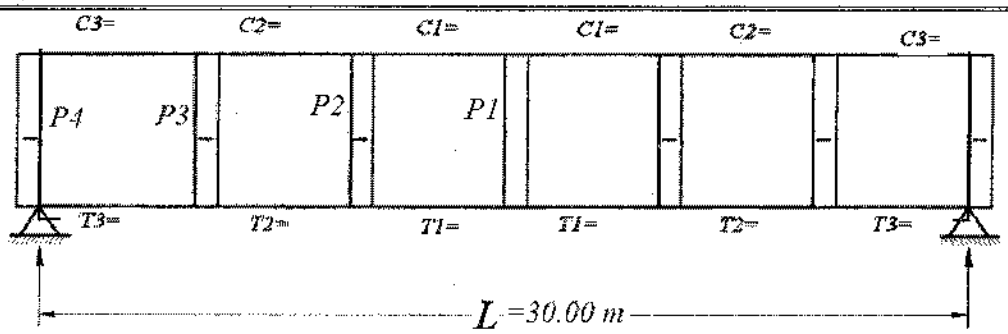
67- R_v = (--) kN [a- 9506 b- 7670 c-1902 d- 1100]



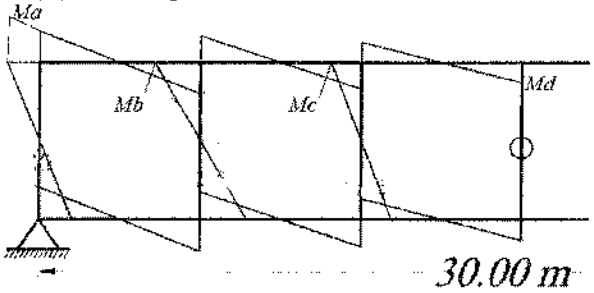
68- M3 = (--) kN.m [a- 53640 b- 48470 c-23670 d- No Ans.]

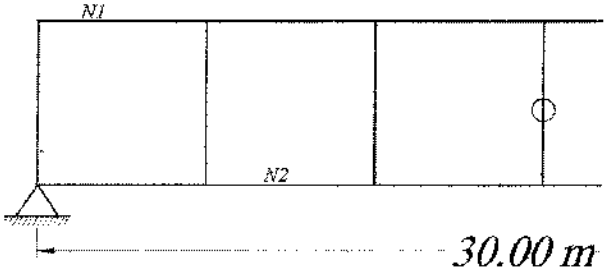
69- M2 = (--) kN.m [a- 52440 b- 47680 c-24400 d- No Ans.]

70- M1 = (--) kN.m [a- 56440 b- 49870 c-29800 d- No Ans.]



71- C1 = (--) kN [a- 10132 b- 7458 c-2480 d- No Ans.]
72- C2 = (--) kN [a- 10452 b- 7748 c-2960 d- No Ans.]
73- C3 = (--) kN [a- 10872 b- 7748 c-2980 d- No Ans.]
74- P3 = (--) kN [a- 2326 b- 1192 c-1542 d- No Ans.]

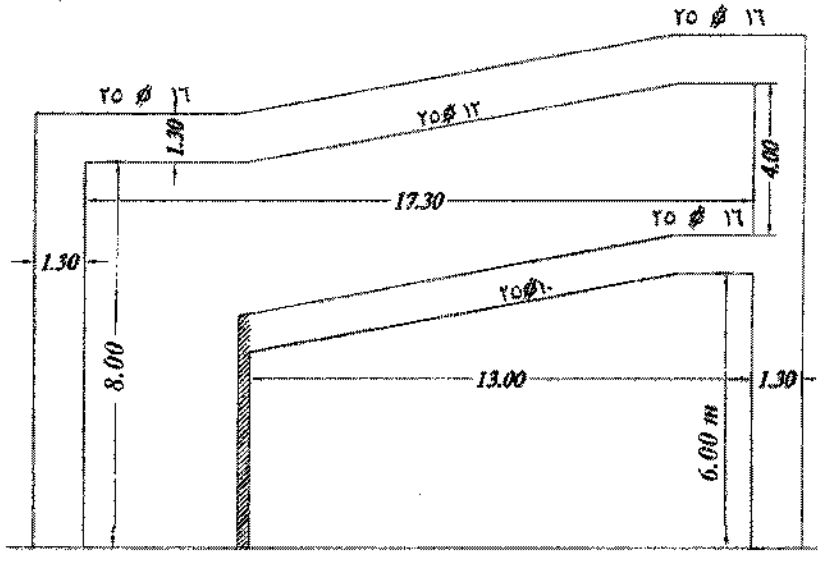




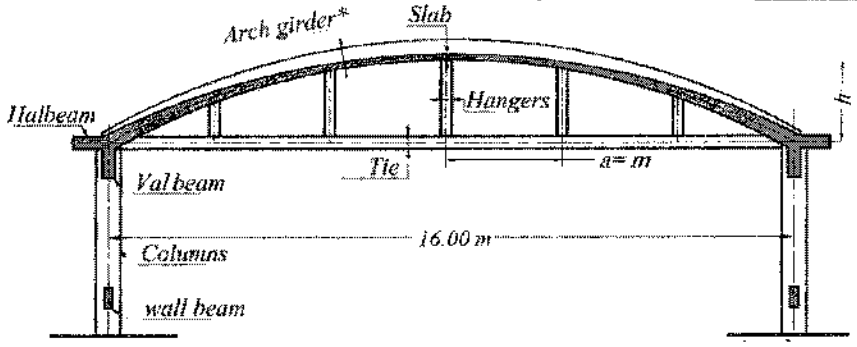
75- Ma = (--) kN.m [a- 7450 b- 4470 c-1490 d- No Ans.]
76- Mb = (--) kN.m [a- 7450 b- 11920 c-1490 d- No Ans.]
77- Mc = (--) kN.m [a- 7450 b- 5960 c-1490 d- No Ans.]
78- Md = (--) kN.m [a- 7450 b- 4470 c-1490 d- No Ans.]
79- N1 = (--) kN [a- 2980 b- 4340 c-1340 d- No Ans.]
80- N2 = (--) kN [a- 7560 b- 4340 c-1788 d- No Ans.]

Question No. 2 (40%), it is required to provide a reinforcement with suitable scale

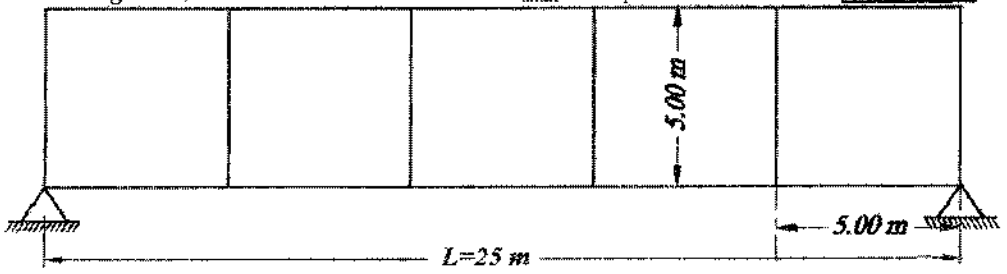
a- For the shown ***frame***, provide a detailed RFT with suitable scale.



b- For the shown ***ARCH slab***, assume the ***all Dims.*** and A_{smin} then provide RFT for a ***half section***



c- For the shown ***vierndeel girder***, calculate the ***all Dims.*** and A_{smin} then provide RFT for a ***half section***



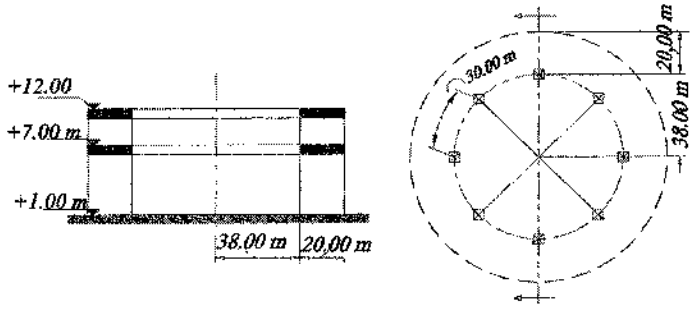
d- For the shown ***ARCH girder*** shown in ***Page 3***, ***assume*** A_s then provide RFT for a ***half section***

Question No. 3 (14%).

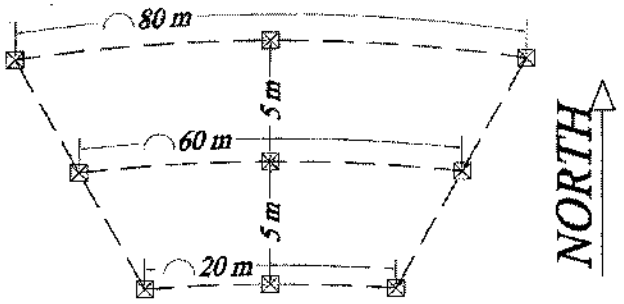
Without any calculation, sketch the lay-out for the shown structures:-

CONSIDERING THE COLUMN IS ALLOWED ON ☒

1-



2-



مع أخلص و اصدق دعواتي القلبية بالاستفادة الكاملة بالمنهج المعطى

د.م/ أحمد عبدالله أحمد حموده و اللجنه

6/6