UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2005/2006

November 2005

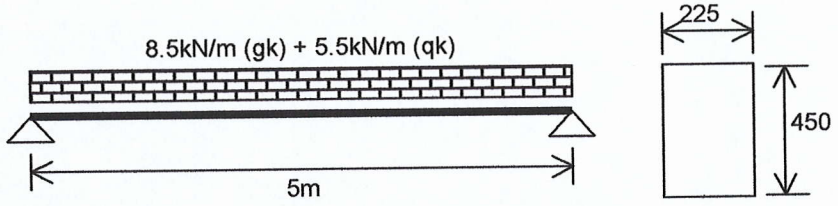
REG 365 – Sturktur Konkrit
Masa: 3 jam

Sila pastikan bahawa kertas peperiksaan ini mengandungi **TUJUH** muka surat yang tercetak sebelum anda memulakan peperiksaan ini.

Jawab **LIMA** soalan.

...2/-

1. Satu rasuk bertopang mudah mempunyai rentang 5m, membawa beban mati 8.5 kN/m dan beban hidup 5.5 kN/m, seperti ditunjukkan dalam **Gambarajah 1**. Saiz rasuk ialah 225 X 450 mm^2. Menggunakan konkrit gred C30 dan keluli utama dengan f_y = 460 N/mm^2 dan keluli perangkai f_y = 250 N/mm^2, rekabentuk rasuk tersebut dengan andaian kedalaman berkesan, d, = 400 mm.



Gambarajah 1.

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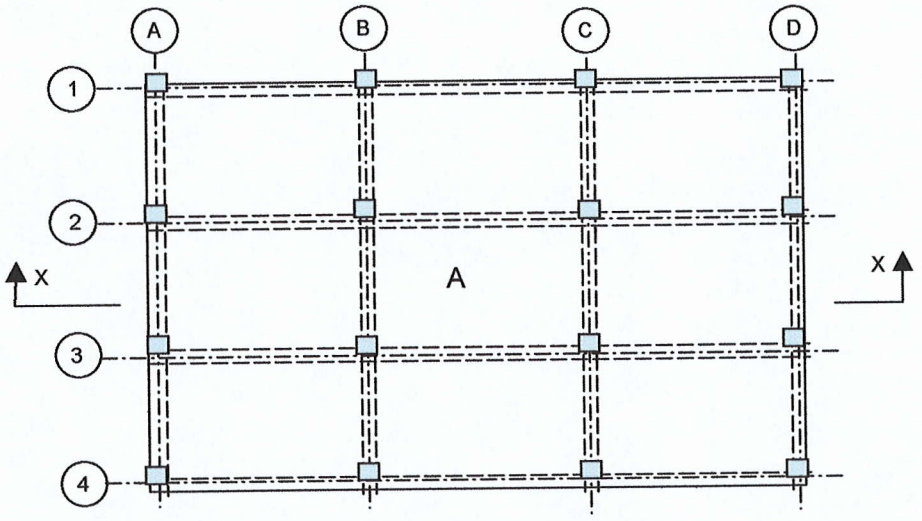
2.



Gambarajah 2

Gambarajah 2 menunjukkan pelan lantai sebuah bangunan. Rekabentukkan lantai A yang mempunyai panjang sisi 5.5m X 3m. Tebal lantai ialah 200mm.

Lantai membawa beban hidup sebesar 5.0kN/m^2 dan beban mati 4.5kN/m^2.

Gunakan yang berikut untuk rekabentuk:

f_y = 460 N/mm^2; f_{cu} = 35 N/mm^2; kedalaman berkesan, d, = 170mm

(20 markah)

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3. Asas pad diperlukan untuk menyokong tiang 350 X 350 mm^2 yang membawa beban mati sebesar 500 kN dan beban hidup 300 kN. Kekuatan galas tanah ialah 200 kN/m^2.

Menggunakan konkrit gred C35 dan keluli fy = 460 N/mm^2 rekabentuk asas tersebut. Anggap tebal konkrit pelindung = 40mm.

(20 markah)

Untuk soalan 1 hingga 3 gunakan maklumat rekabentuk yang berikut:

Maklumat rekabentuk:

Momen lentur muktamad, M_u, BS8110;

$$M_u = 0.156 f_{cu} bd^2$$

Dan luas keluli (A_s);

$$A_s = \frac{M}{0.95 f_y z}$$

Dengan $$z = d\left[0.5 + \sqrt{(0.25 - K/0.9)}\right] \text{ dan } K = \frac{M}{f_{cu} bd^2}$$

BS 8110 klaus 3.4.4.1 menghadkan z tidak melebihi 0.95d.

Table 3.8 BS 8110 : Values of concrete shear stress, (v_c) (N/mm^2)

$\frac{100A_s}{b_v d}$	Effective depth mm							
	125	150	175	200	225	250	300	≥ 400
	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2
≤ 0.15	0.45	0.43	0.41	0.40	0.39	0.38	0.36	0.34
0.25	0.53	0.51	0.49	0.47	0.46	0.45	0.43	0.40
0.50	0.67	0.64	0.62	0.60	0.58	0.56	0.54	0.50
0.75	0.77	0.73	0.71	0.68	0.66	0.65	0.62	0.57
1.00	0.84	0.81	0.78	0.75	0.73	0.71	0.68	0.63
1.50	0.97	0.92	0.89	0.86	0.83	0.81	0.78	0.72
2.00	1.06	1.02	0.98	0.95	0.92	0.89	0.86	0.80
≥ 3.00	1.22	1.16	1.12	1.08	1.05	1.02	0.98	0.91

Values given in the table are for concrete grade 25. For other concrete grades up to grade 40, the value obtained from the table should be multiplied by factor $(f_{cu}/25)^{1/3}$.

Table 3.7 of BS 8110 recommends forms of shear reinforcement.

Table 3.7 BS 8110

Value of v N/mm^2	Form of shear reinforcement to be provided	Area of shear reinforcement to be provided
Less than $0.5v_c$ throughout the beam	See NOTE 1	—
$0.5v_c < v < (v_c + 0.4)$	Minimum links for whole length of beam	$A_{sv} \geq 0.4b_v s_v/0.95f_{yv}$ (see NOTE 2)
$(v_c + 0.4) < v < 0.8\sqrt{f_{cu}}$ or 5 N/mm^2	Links or links combined with bent-up bars. Not more than 50 % of the shear resistance provided by the steel may be in the form of bent-up bars (see NOTE 3)	Where links only provided: $A_{sv} \geq b_v s_v(v - v_c)/0.95f_{yv}$ Where links and bent-up bars provided: see **3.4.5.6**

NOTE 1. While minimum links should be provided in all beams of structural importance, it will be satisfactory to omit them in members of minor structural importance such as lintels or where the maximum design shear stress is less than half v_c.
NOTE 2. Minimum links provide a design shear resistance of 0.4 N/mm^2.
NOTE 3. See **3.4.5.5** for guidance on spacing of links and bent-up bars.

Table 3.25 BS 8110: Minimum Percentages of Reinforcement

Situation	Definition of percentage	Minimum percentage	
		f_y = 250 N/mm^2 %	f_y = 460 N/mm^2 %
Tension reinforcement			
Sections subjected mainly to pure tension	$100A_s/A_c$	0.8	0.45
Sections subjected to flexure:			
a) flanged beams, web in tension:			
1) $b_w/b < 0.4$	$100A_s/b_w h$	0.32	0.18
2) $b_w/b \geq 0.4$	$100A_s/b_w h$	0.24	0.13
b) flanged beams, flange in tension:			
1) T-beam	$100A_s/b_w h$	0.48	0.26
2) L-beam	$100A_s/b_w h$	0.36	0.20
c) rectangular section (in solid slabs this minimum should be provided in both directions)	$100A_s/A_c$	0.24	0.13
Compression reinforcement (where such reinforcement is required for the ultimate limit state)			
General rule	$100A_{sc}/A_{cc}$	0.4	0.4
Simplified rules for particular cases:			
a) rectangular column or wall	$100A_{sc}/A_c$	0.4	0.4
b) flanged beam:			
1) flange in compression	$100A_{sc}/bh_f$	0.4	0.4
2) web in compression	$100A_{sc}/b_w h$	0.2	0.2
c) rectangular beam	$100A_{sc}/A_c$	0.2	0.2
Transverse reinforcement in flanges or flanged beams (provided over full effective flange width near top surface to resist horizontal shear)	$100A_{st}/h_f l$	0.15	0.15

Bending Moment Coefficients for rectangular panels supported on four sides

Type of panel and moments considered	Short span coefficients, β_{sx}								Long span coefficients, β_{sy} for all values of l_y/l_x
	Values of l_y/l_x								
	1.0	1.1	1.2	1.3	1.4	1.5	1.75	2.0	
Interior panels									
Negative moment at continuous edge	0.031	0.037	0.042	0.046	0.050	0.053	0.059	0.063	0.032
Positive moment at mid-span	0.024	0.028	0.032	0.035	0.037	0.040	0.044	0.048	0.024
One short edge discontinuous									
Negative moment at continuous edge	0.039	0.044	0.048	0.052	0.055	0.058	0.063	0.067	0.037
Positive moment at mid-span	0.029	0.033	0.036	0.039	0.041	0.043	0.047	0.050	0.028
One long edge discontinuous									
Negative moment at continuous edge	0.039	0.049	0.056	0.062	0.068	0.073	0.082	0.089	0.037
Positive moment at mid-span	0.030	0.036	0.042	0.047	0.051	0.055	0.062	0.067	0.028
Two adjacent edges discontinuous									
Negative moment at continuous edge	0.047	0.056	0.063	0.069	0.074	0.078	0.087	0.093	0.045
Positive moment at mid-span	0.036	0.042	0.047	0.051	0.055	0.059	0.065	0.070	0.034
Two short edges discontinuous									
Negative moment at continuous edge	0.046	0.050	0.054	0.057	0.060	0.062	0.067	0.070	—
Positive moment at mid-span	0.034	0.038	0.040	0.043	0.045	0.047	0.050	0.053	0.034
Two long edges discontinuous									
Negative moment at continuous edge	—	—	—	—	—	—	—	—	0.045
Positive moment at mid-span	0.034	0.046	0.056	0.065	0.072	0.078	0.091	0.100	0.034
Three edges discontinuous (one long edge continuous)									
Negative moment at continuous edge	0.057	0.065	0.071	0.076	0.081	0.084	0.092	0.098	—
Positive moment at mid-span	0.043	0.048	0.053	0.057	0.060	0.063	0.069	0.074	0.044
Three edges discontinuous (one short edge continuous)									
Negative moment at continuous edge	—	—	—	—	—	—	—	—	0.058
Positive moment at mid-span	0.042	0.054	0.063	0.071	0.078	0.084	0.096	0.105	0.044
Four edges discontinuous									
Positive moment at mid-span	0.055	0.065	0.074	0.081	0.087	0.092	0.103	0.111	0.056

Clause 3.5.3.4 BS8110, the maximum design bending moments per unit width are given by

$$m_{sx} = \beta_{sx} n l_x^{\,2}\text{; and } m_{sy} = \beta_{sy} n l_x^{\,2}$$

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Table 3.19 Cross-sectional area per metre width for various bar spacing (mm^2)

Bar size (mm)	*Spacing of bars*								
	50	*75*	*100*	*125*	*150*	*175*	*200*	*250*	*300*
6	566	377	283	226	189	162	142	113	94.3
8	1 010	671	503	402	335	287	252	201	168
10	1 570	1 050	785	628	523	449	393	314	262
12	2 260	1 510	1 130	905	754	646	566	452	377
16	4 020	2 680	2 010	1 610	1 340	1 150	1 010	804	670
20	6 280	4 190	3 140	2 510	2 090	1 800	1 570	1 260	1 050
25	9 820	6 550	4 910	3 930	3 270	2 810	2 450	1 960	1 640
32	16 100	10 700	8 040	6 430	5 360	4 600	4 020	3 220	2 680
40	25 100	16 800	12 600	10 100	8 380	7 180	6 280	5 030	4 190

Table 3.7 Cross-sectional areas of groups of bars (mm^2)

Bar size (mm)	*Number of bars*									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
6	28.3	56.6	84.9	113	142	170	198	226	255	283
8	50.3	101	151	201	252	302	352	402	453	503
10	78.5	157	236	314	393	471	550	628	707	785
12	113	226	339	452	566	679	792	905	1 020	1 130
16	201	402	603	804	1 010	1 210	1 410	1 610	1 810	2 010
20	314	628	943	1 260	1 570	1 890	2 200	2 510	2 830	3 140
25	491	982	1 470	1 960	2 450	2 950	3 440	3 930	4 420	4 910
32	804	1 610	2 410	3 220	4 020	4 830	5 630	6 430	7 240	8 040
40	1 260	2 510	3 770	5 030	6 280	7 540	8 800	10 100	11 300	12 600

...7/-

4. Bincang dan huraikan **sifat-sifat konkrit bertetulang.**

(20 markah)

5. Huraikan dengan perincian beberapa jenis pengujian konkrit yang di jalankan di makmal. Mulakan dari persediaan spesimen-spesimen sehingga selesai pengujian-pengujian tersebut.

(20 markah)

6. Dengan memberi lakaran nyatakan beberapa penggunaan struktur konkrit bertetulangan. Bincangkan dengan memberi beberapa contoh.

(20 markah)

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