UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang 1990/91

Oktober/November 1990

REG 262 Kejuruteraan 3(Struktur)

Masa : (3 Jam)

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

Jawab LIMA soalan. TIGA dari Bahagian A dan DUA dari Bahagian B.

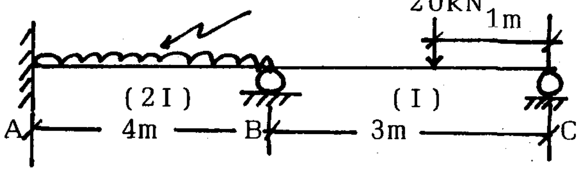
Bahagian A

1. (a) Bincangkan dengan contoh-contoh yang sesuai tentang kelebihan struktur yang berketentuan dan yang tidak berketentuan.

   (b) Tunjukkan dengan contoh-contoh, dua pendekatan utama bagaimana struktur yang tidak berketentuan boleh dianalisis.

(20 markah)

2. (a) Kirakan tindakbalas serta lukisan gambarajah daya ricih dan momen lentur untuk sistem rasuk Rajah 2.



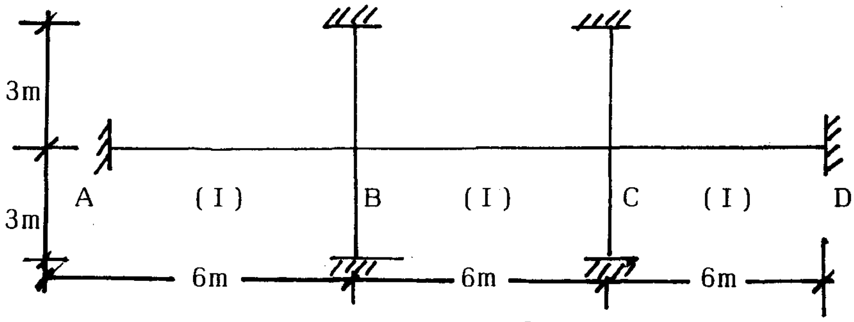
Rajah 2

   (b) Jika sambungan di C (Rajah 2) adalah dibina dalam, berapakah pertukaran nilai momen di A?

(20 markah)

3. (a) Kirakan momen lentur maksimum direntang rasuk BC untuk subkerangka di dalam Rajah 3.

(b) Tunjukkan kesemua kes pembebanan untuk mendapatkan momen-momen maksimum pada rasuk ABCD.



Ambil
G_k = 4kN/m,
Q_k = 3kN/m.

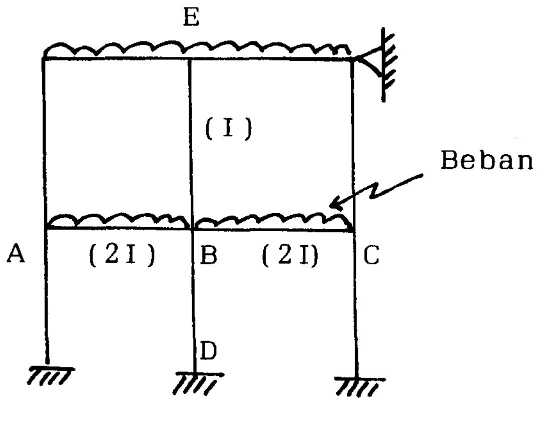
Rajah 3

(20 markah)

4. Satu kerangka sesatah dua tingkat dibebani oleh beban berikut; G_k = 5kN/m dan Q_k = 12kN/m.

(a) Dengan menggunakan kemudahan analisis subkerangka, kirakan momen dalam tiang BE dan BD. (Rajah 4)

(b) Huraikan tiga cara bagaimana rasuk ABC boleh dianalisis dengan menggunakan kaedah agihan momen.

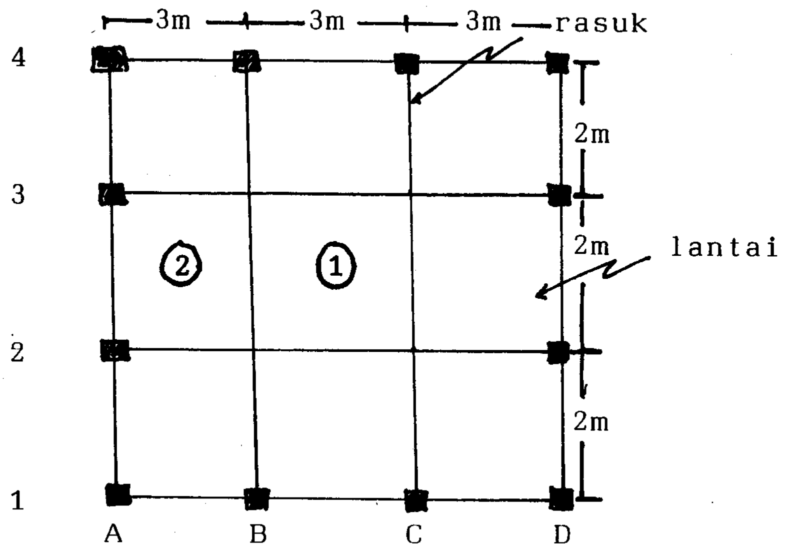


Rajah 4

(20 markah)

5. Pelan lantai konkrit bangunan bertingkat ditunjukkan dalam Rajah 5. Tentukan jumlah beban ke atas rasuk ① ABCD dan ② ABCD serta kirakan momen positif dan negatif dalam panel lantai ① dan ②.

Ambil Jumlah Beban Mati $G_k = 3.6 kN/m^2$
Beban Hidup $Q_k = 2 kN/m^2$

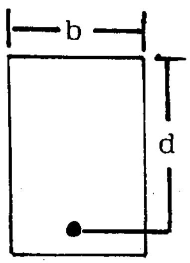


Ambil
$G_k = 3.6 kN/m^2$
$Q_k = 2 kN/m^2$

Rajah 5

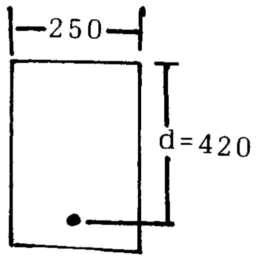
(20 markah)

6. (a) Buktikan bahawa momen rintangan maksimum sebuah rasuk bertulang tunggal adalah $M = 0.156\ f_{cu}\ bd^2$



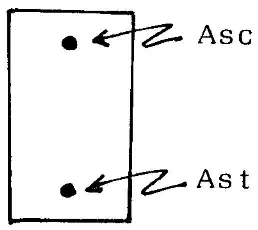
Rajah 6(a)

(b) Momen rekabentuk maksimum keratan Rajah 6(b) adalah 100kN/m. Tentukan luas keratan tetulang dalam tegangan (Ast) jika f_y = 460N/mm² dan f_{cu} = 25N/mm².



Rajah 6(b)

(c) Jika momen rekabentuk maksimum bertambah kepada 200kN/m dalam (b) tentukan luas keratan tetulang, Ast dan Asc yang diperlukan.

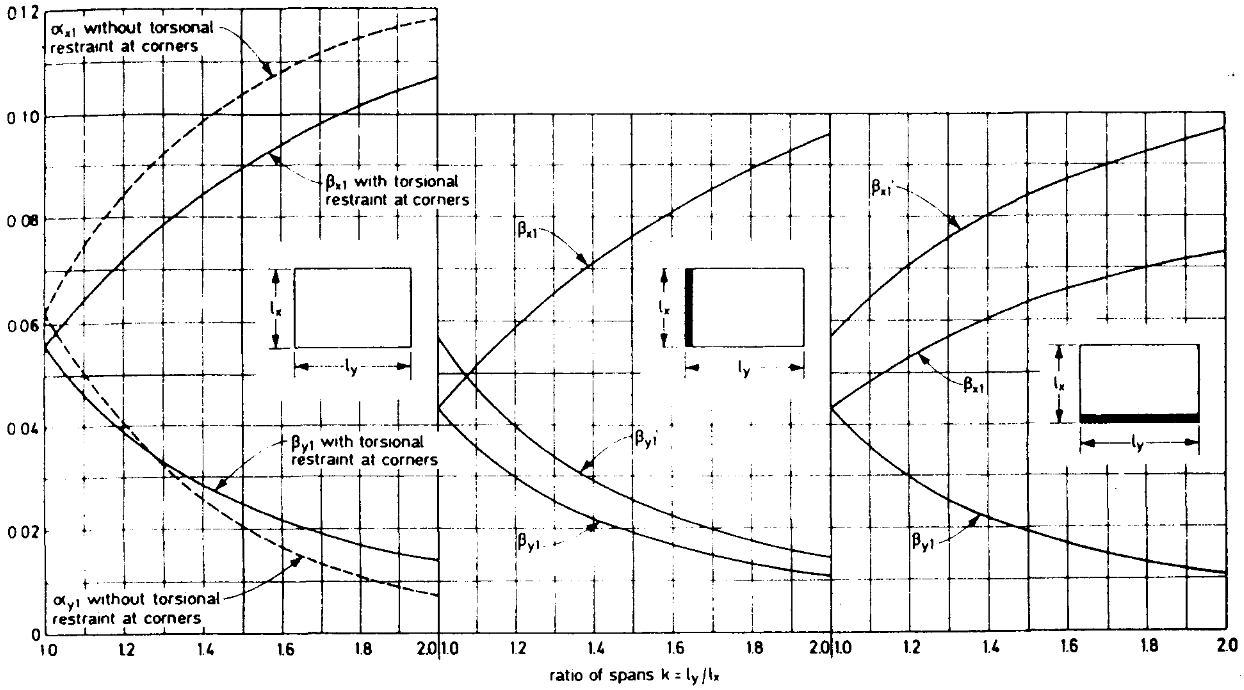


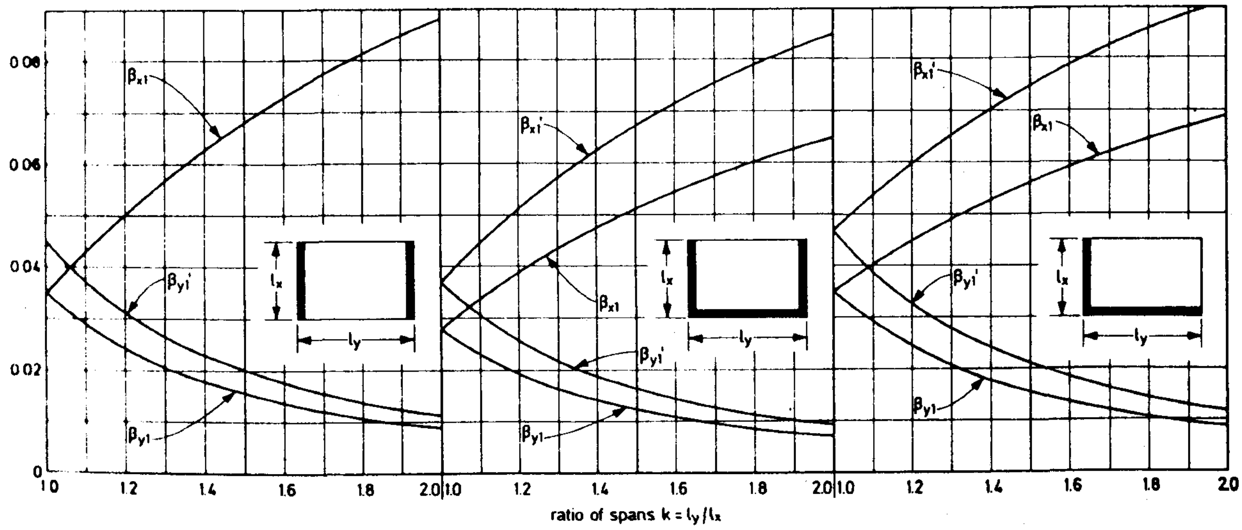
Rajah 6(c)

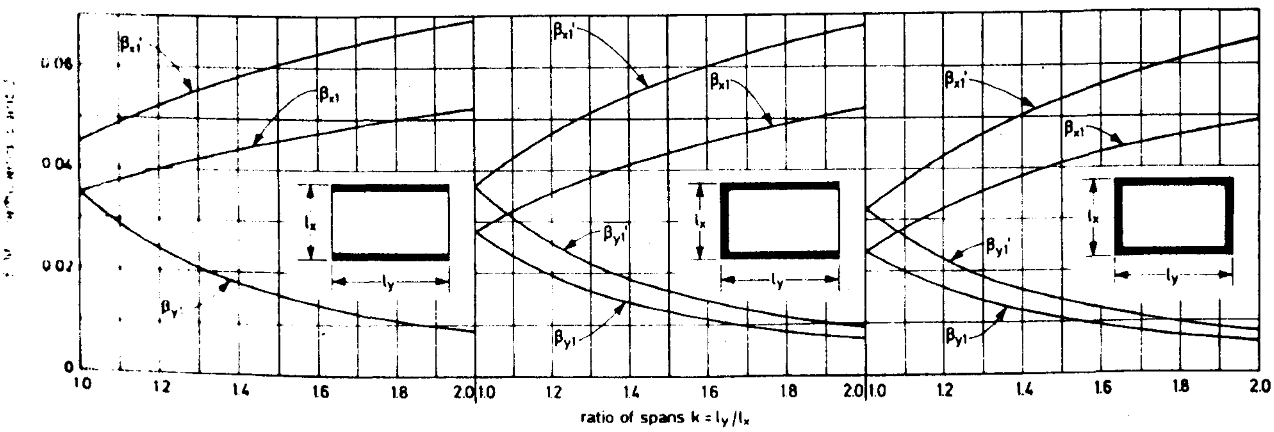
(20 markah)

- oooOOooo -

Two-way slabs: Rectangular panels: Uniform load: CP 110 requirements TABLE 51







------ :edge which is discontinuous or which is cast monolithically with support.

▬▬▬ :edge which is continuous.

Bending-moment coefficients β_{x1} and β_{x1}' apply to maximum positive and negative bending moments respectively on short span l_x.

Bending-moment coefficients β_{y1} and β_{y1}' apply to maximum positive and negative bending moments respectively on long span l_y.

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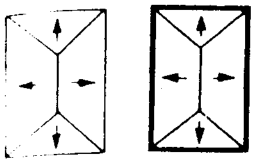
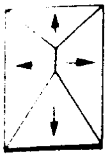
Two-way slabs: Rectangular panels: Loads on beams

TABLE 62

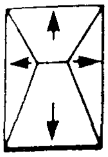
Panels supported along four edges



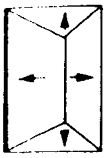
$k > 1$: $R_1 = R_3 = \frac{1}{4} w l_x^2$
$R_2 = R_4 = \frac{1}{2}(k - \frac{1}{2}) w l_x^2$
$\alpha = \beta = 1/2k$
$k = 1$: $R_1 = R_2 = R_3 = R_4 = \frac{1}{4} w l_x^2$



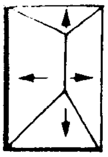
$k \not< 1\frac{1}{3}$: $R_1 = \frac{1}{4} w l_x^2$ (min.) $\alpha = 1/2k$ (min.)
$R_2 = R_4 = \frac{1}{2}(k - \frac{2}{3}) w l_x^2$
$R_3 = \frac{5}{12} w l_x^2$ (max.) $\beta = 5/6k$ (max.)



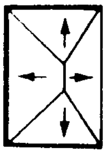
$k \leqslant 1\frac{1}{3}$: $R_1 = \frac{3}{5} R_3$ approx. (min.) $\alpha = 3k/8$
$\beta = 5k/8$
$R_2 = R_4 = \frac{3}{16} k^2 w l_x^2$ $\psi = \xi = 3k/8$
$R_3 = \frac{5}{8} k(1 - \frac{3}{8} k) w l_x^2$ approx. (max.)



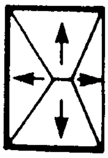
$R_1 = R_3 = \frac{3}{16} w l_x^2$
$R_2 = \frac{3}{5} R_4$ (min.)
$R_4 = \frac{5}{8}(k - \frac{3}{8}) w l_x^2$ (max.)
$\alpha = \beta = \frac{3}{8} k$ $\psi = \frac{5}{8}$ (max.)



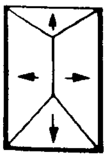
$R_1 = \frac{3}{16} w l_x^2$ (min.) $\alpha = \beta = 3/8k$
$R_2 = \frac{3}{5} R_4$ (min.) $\beta = 5/8k$ (max.)
$R_3 = \frac{5}{16} w l_x^2$ (max.) $\psi = \frac{5}{8}$ (max.)
$R_4 = \frac{5}{8}(k - \frac{1}{2}) w l_x^2$ (max.)



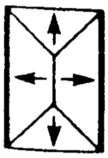
$k \not< 1\frac{1}{4}$: $R_1 = R_3 = \frac{5}{16} w l_x^2$ $\alpha = \beta = \frac{5}{8} k$
$R_2 = \frac{3}{5} R_4$ (min.) $\psi = \frac{5}{8}$ (max.)
$R_4 = \frac{5}{8}(k - \frac{5}{8}) w l_x^2$ (max.)



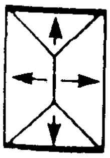
$k \leqslant 1\frac{1}{4}$: $R_1 = R_3 = \frac{1}{2} k(1 - \frac{3}{10} k) w l_x^2$ $\alpha = \beta = k/2$
$R_2 = \frac{1}{20} k^2 w l_x^2$ (min.)
$R_4 = \frac{1}{4} k^2 w l_x^2$ (max.) $\psi = k/2$ $\xi = 3k/10$



$R_1 = \frac{7}{20} w l_x^2$ (min.) $\alpha = 3/10k$ (min.)
$R_2 = R_4 = \frac{1}{2}(k - \frac{3}{5}) w l_x^2$
$R_3 = \frac{1}{4} w l_x^2$ (max.) $\beta = 1/2k$ (max.)

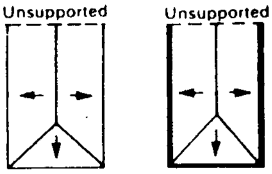


$R_1 = R_3 = \frac{3}{20} w l_x^2$ (min.)
$R_2 = R_4 = \frac{1}{2}(k - \frac{3}{10}) w l_x^2$ (max.)
$\alpha = \beta = 3/10k$ (min.)

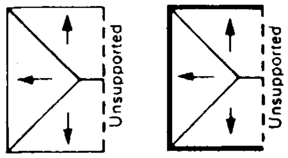


$k \not< 1\frac{2}{3}$: $R_1 = R_3 = \frac{5}{12} w l_x^2$ (min.)
$R_2 = R_4 = \frac{1}{2}(k - \frac{5}{6}) w l_x^2$ (max.)
$\alpha = \beta = 5/6k$ (min.)

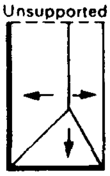
Panels unsupported along one edge



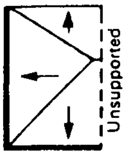
$R_1 = 0$
$R_2 = R_4 = \frac{1}{2}(k - \frac{1}{4}) w l_x^2$
$R_3 = \frac{1}{4} w l_x^2$
$\beta = 1/2k$



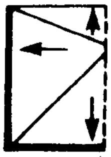
$k \not> 2$: $R_1 = R_3 = \frac{1}{2} k(1 - \frac{1}{4} k) w l_x^2$
$R_2 = 0$
$R_4 = \frac{1}{4} k^2 w l_x^2$
$\psi = k/2$



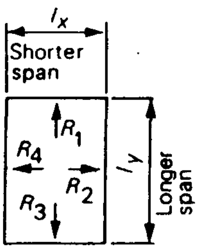
$R_1 = 0$ $\beta = 5/8k$
$R_2 = \frac{3}{5} R_4$ (min.) $\psi = \frac{5}{8}$
$R_3 = \frac{5}{16} w l_x^2$
$R_4 = \frac{5}{8}(k - \frac{5}{16}) w l_x^2$ (max.)



$k \not> 1\frac{3}{5}$: $R_1 = \frac{3}{5} R_3$ (min.) $R_2 = 0$
$R_3 = \frac{5}{8} k(1 - \frac{5}{16} k) w l_x^2$ (max.)
$R_4 = \frac{5}{16} k^2 w l_x^2$ $\alpha = \frac{5}{8}$ $\psi = 5k/8$



$k \geqslant 1\frac{3}{5}$: $R_1 = \frac{1}{10} w l_x^2$ (min.) $R_2 = 0$
$R_3 = \frac{1}{2} w l_x^2$
$R_4 = (k - \frac{3}{5}) w l_x^2$ (max.)
$\alpha = 3/5k$ $\beta = 1/k$



$k = \dfrac{l_y}{l_x} = \dfrac{\text{Longer span}}{\text{Shorter span}}$

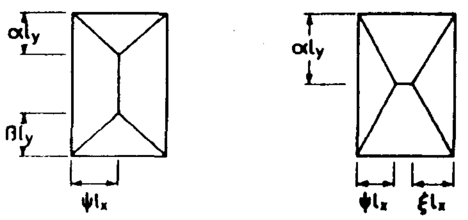
w = Intensity of uniformly-distributed service load per unit area.

If analysis due to ultimate loads is undertaken, substitute n for w in appropriate formulæ.

R_1, R_2, R_3, R_4 = total load carried by each support of panel.

Condition of supports
- - - - - - - - = No support
———————— = Freely supported
▬▬▬▬▬▬ = Continuity or fixity

Loads marked (min.) apply if panel is entirely freely supported along edge indicated: if partially restrained, load will be slightly greater than given and load marked (max.) on opposite edge will be correspondingly reduced.



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