UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2006/2007

April 2007

REG 262 – Rekabentuk Struktur
Structural Design

Masa: 3 jam
Duration : 3 hours

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

*Please check that this examination paper consists of **EIGHT** pages of printed material before you begin the examination.*

Jawab **SEMUA** soalan.

*Answer **ALL** questions.*

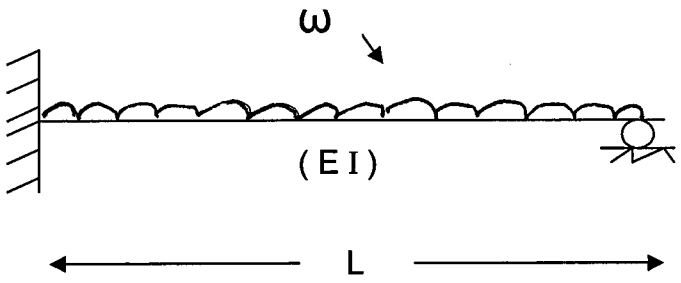
1. (a) Apakah kelebihan yang terdapat pada struktur tidak boleh tentu serta berikan beberapa contoh struktur rasuk, kekuda dan kerangka yang tidak boleh tentu.

What are the advantages of an indeterminate structure and show some examples of indeterminate beams, trusses and frames.

(b) Jelaskan bagaimana kaedah kecacatan konsisten dapat digunakan untuk penyelesaian struktur tidak boleh tentu di **Rajah 1**.

Explain how the Method of Consistent Deformation can be used to solve for the simple indeterminate beam shown in ***Figure 1****.*

(20 markah/*marks*)



Rajah 1 ***(Figure 1)***

ω - beban seragam

L - panjang rasuk

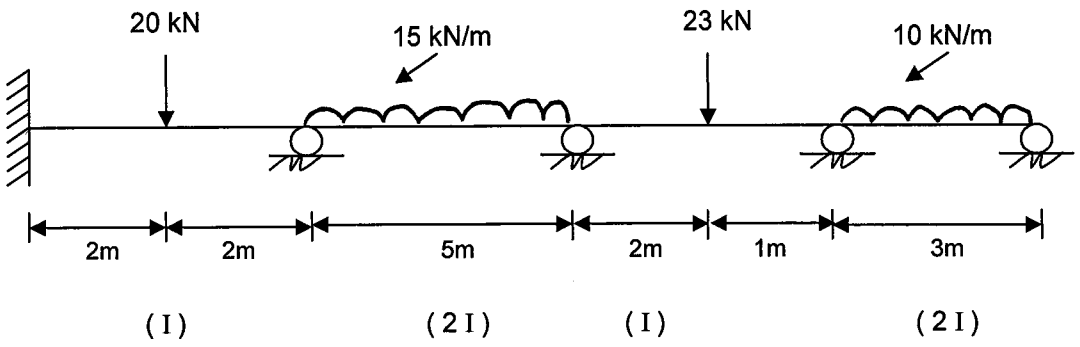
E - Modula keanjalan Bahan rasuk

I - Momen sifat tekan keratan rasuk

...3/-

2. Kirakan tindakbalas serta lukiskan gambarajah Daya Ricih dan Momen Lentur untuk sistem rasuk di **Rajah 2**.

*Find the reaction and draw the shear force and bending moment diagrams for the beam shown in **Figure 2**.*

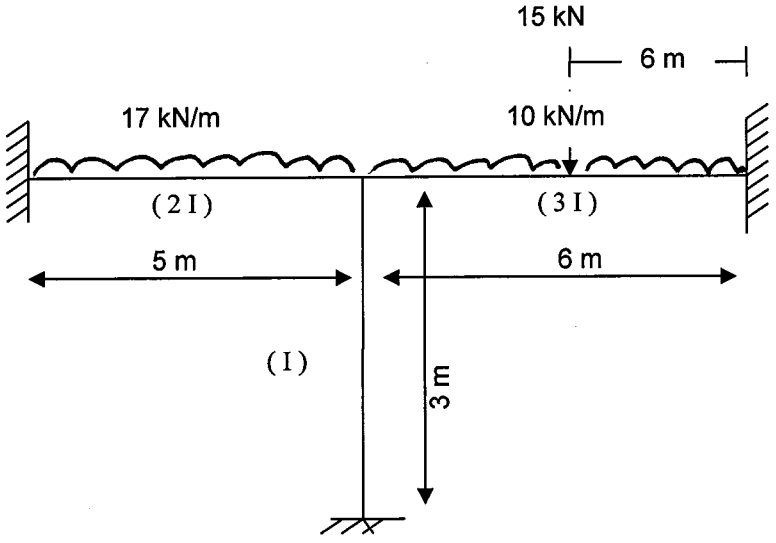


Rajah 2 ***(Figure 2)***

(20 markah/*marks*)

3. Kirakan semua tindakbalas, daya ricih serta gambarajah momen lentur untuk sistem kerangka di **Rajah 3**.

*Find the reactions, shear forces and sketch the bending moment diagrams for the sub-frame system shown in **Figure 3**.*



Rajah 3 ***(Figure 3)***

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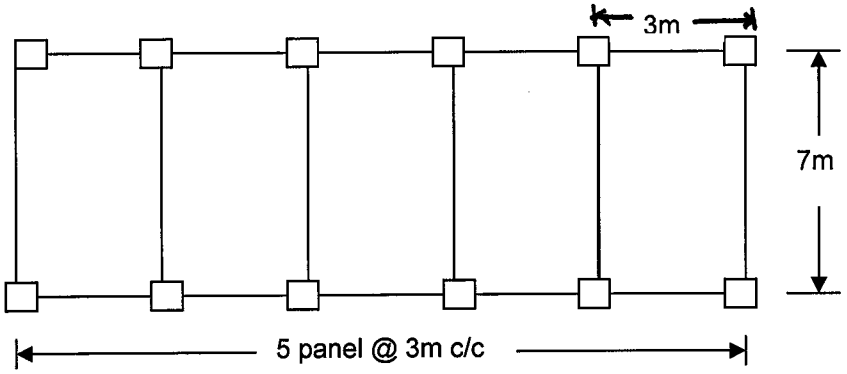
4. (a) Jelaskan prinsip dan kaedah yang digunakan apabila menganalisis sebuah lantai yang berterusan seperti yang ditunjukkan di **Rajah 4 (a)**.

*Explain the principles and method that is used when analyzing a continuous slab system as shown in **Figure 4 (a)**.*



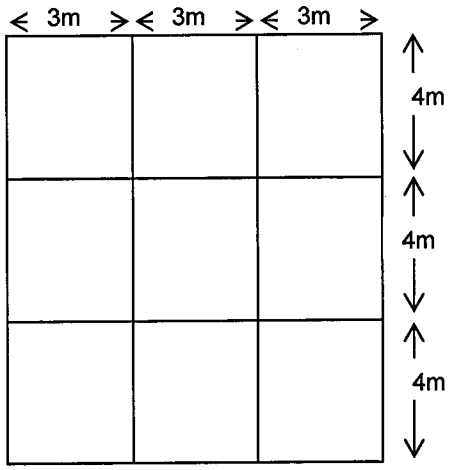
Rajah 4(a) ***[Figure 4(a)]***

(b) Kirakan momen lentur positif dan negatif untuk panel-panel lantai yang ditunjukkan dalam **Rajah 4 (b)** di bawah.

Ketebalan Lantai = 150 mm
Ketumpatan Konkrit Bertulang = 24 kM/m^3
Beban Hidup = 1.5 kM/m^2
(Sila lihat **Lampiran 1**)

*Calculate the positive and negative bending moments for the panel system shown in **Figure 4 (b)**.*

Thickness of Slab = 150 mm
Density of R.C. Slab = 24 kN/m^3
Live Load = 1.5 kN/m^2
*(See **Attachment 1**)*



Rajah 4 (b)
[Figure 4 (b)]

(20 markah/*marks*)

5. Satu rasuk mudah yang ditunjukkan dalam **Rajah 5** dikenakan beban mati dan beban kenaan. Beban mati (termasuk swa-berat) tersebut adalah 10 kN/m dan beban kenaan adalah 8 kN/m. Tentukan:-

(a) Momen rekabentuk

(b) Momen rintangan muktamad (M_u)

(c) Luas tetulang yang diperlukan untuk menanggung beban berkenaan.

Anggap kekuatan ciri bahan adalah

f_{cu} = 25N/mm^2 (konkrit), f_y (keluli) = 460 N/mm^2

*A simply supported beam shown in **Figure 5** is subjected to dead load and imposed load. The dead load including self-weight of 10 kN/m and imposed load of 8 kN/m. Determine:-*

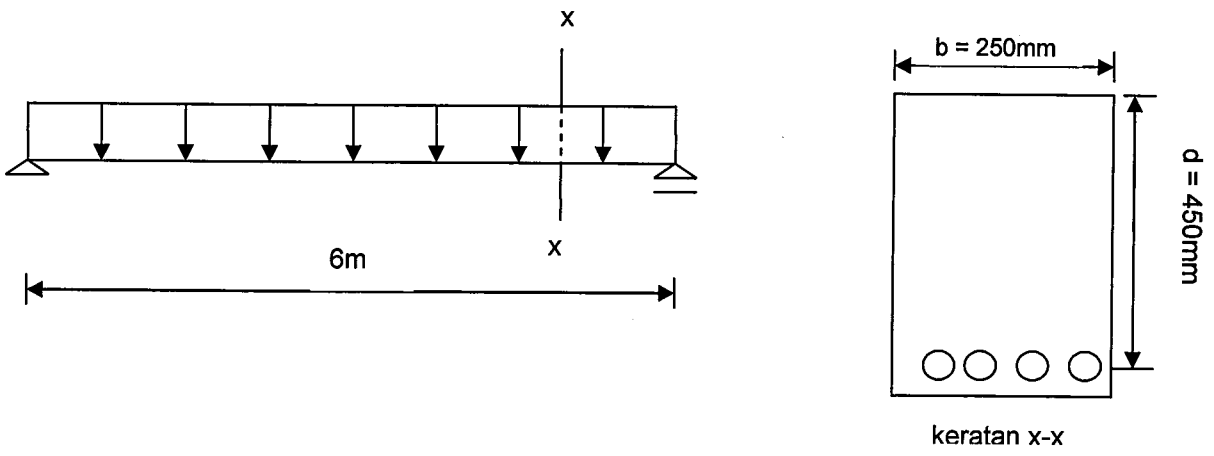
(a) Design moment

(b) Ultimate moment of resistance (Mu)

(c) Area of reinforcement required to resist the loads

Assume the characteristic material strength are

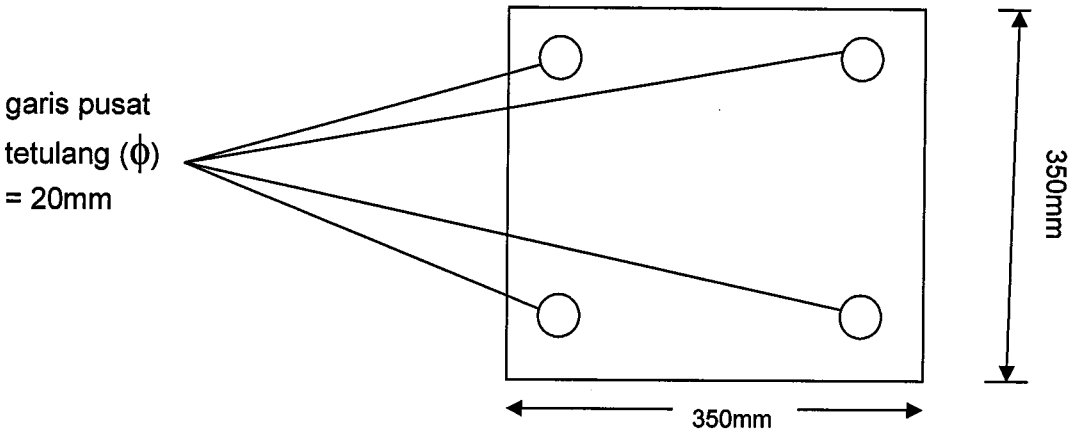
f_{cu} = 25N/mm^2 (concrete), f_y (steel) = 460 N/mm^2



Rajah 5 *(Figure 5)*

6. (a) Semak sama ada tiang konkrit bertetulang yang ditunjukkan dalam **Rajah 6 (a)** sesuai untuk menanggung beban paksi 1600 kN. Anggap kekuatan ciri bahan adalah f_{cu} = 25N/mm^2 (konkrit), f_y (keluli) = 460 N/mm^2.

*Check whether the reinforced concrete column shown in **Figure 6 (a)** would be adequate to resist an axial load of 1600 kN. Assume the characteristic material strength are f_{cu} = 25N/mm^2 (concrete), f_y (steel) = 460 N/mm^2*



Rajah 6(a) ***[Figure 6(a)]***

(b) Satu rasuk konkrit bertetulang yang mempunyai kelebaran(b) 230mm, kedalaman 350mm dan rentang 8m perlu untuk menanggung beban mati dan beban kenaan **Rajah 6 (b)**. Beban mati termasuk swa-berat adalah 3 kN/m dan beban kenaan 4 kN/m. Bahan yang digunakan adalah konkrit gred 25 (f_{cu} = 25N/mm^2) dan tetulang keluli tegangan tinggi (f_y = 460 N/mm^2). Anggap keadaan pendedahan adalah sederhana (penutup konkrit = 40mm) dan garis pusat tetulang tegangan adalah 25mm. Tentukan:-

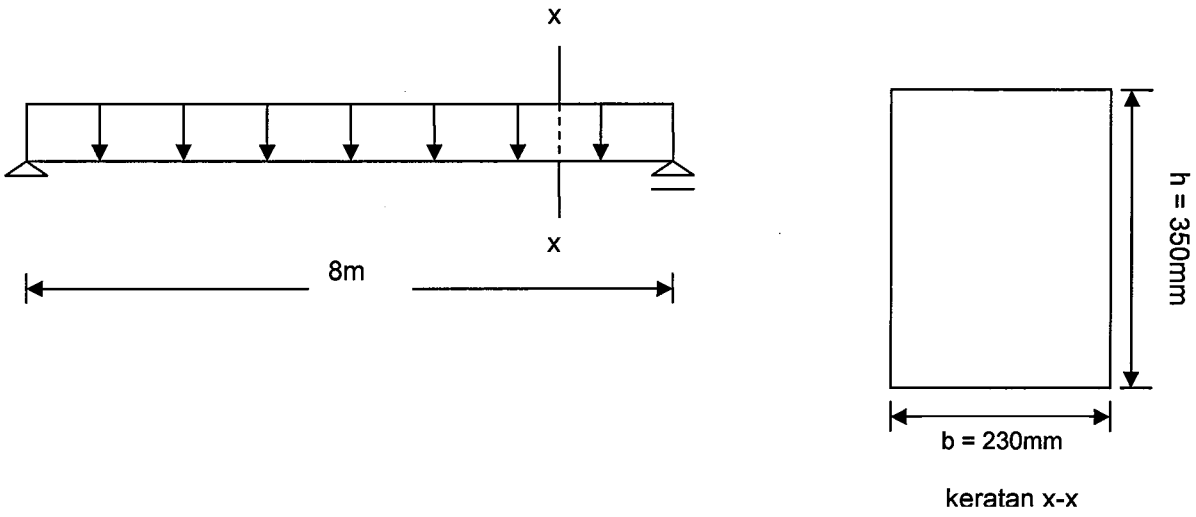
(i) keluasan tetulang mampatan

(ii) keluasan tetulang tegangan

(b) *A reinforced concrete which is 230mm wide, 350mm deep and spans 8m required to support dead load and imposed load* ***Figure 6 (b)****. The dead load including self-weight is 3 kN/m and imposed load is 4 kN/m. The material to be used are grade 25 concrete (f_{cu} = 25N/mm^2) and high tensile steel reinforcement (f_y = 460 N/mm^2). Assume the exposure condition is mild (concrete cover = 40mm) and diameter of tension reinforcement is 25mm. Determine:-*

(i) *Area of compression reinforcement*

(ii) *Area of tension reinforcement*



Rajah 6(b) ***[Figure 6(b)]***

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Table 3.15 Bending moment coefficients for rectangular panels supported on four sides with provision for torsion at corners

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