UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2008/2009

April/May 2009

REG 262 – *Structural Design*
[Rekabentuk Struktur]

Duration: 3 hours
[Masa: 3 jam]

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

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

Students are allowed to answer all questions either in English OR in Bahasa Malaysia only.

Pelajar dibenarkan menjawab semua soalan dalam Bahasa Inggeris ATAU Bahasa Malaysia sahaja.

Answer **FIVE** questions.

*Jawab **LIMA** soalan.*

1. (a) Briefly explain the following terms:-

(i) Static equilibrium equations

(ii) Methods of Consistent Deformations

Secara ringkas terangkan terma berikut:-

(i) Persamaan keseimbangan statik

(ii) Kaedah Kecacatan Kekal

(6 marks/*markah*)

(b) Using methods of Consistent Deformations, find reactions of the beam shown in **Figure 1.0,** which is statically indeterminate to the first degree (n=1).

Menggunakan kaedah kecacatan kekal dapatkan tindakbalas-tindakbalas untuk rasuk seperti ditunjukkan dalam ***Rajah 1.0*** *yang mana adalah statik tak tentu dengan satu darjah (n=1).*

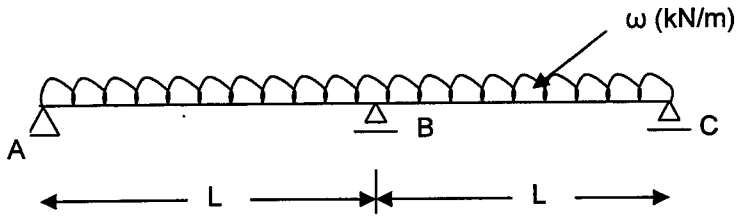


Figure 1.0/*Rajah 1.0*

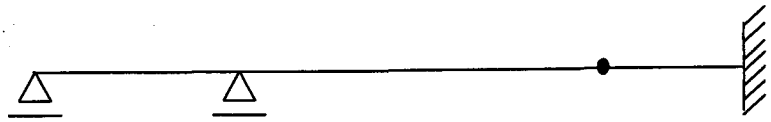
(14 marks/*markah*)

2. (a) Calculate the indeterminacy of the following structures. (**Figure 2.0**)

Kira ketidakketentuan untuk struktur-struktur berikut. ***(Rajah 2.0)***

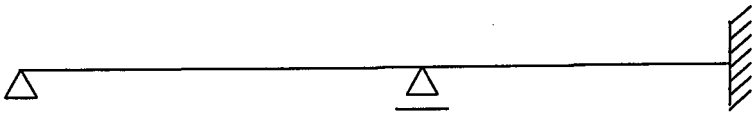
(i)

(ii)



(iii)

(iv)



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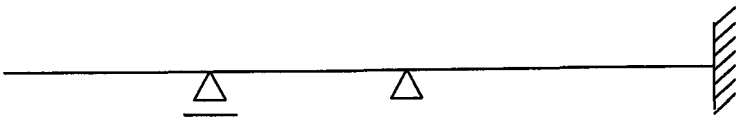


Figure 2.0/*Rajah 2.0*

(5 marks/*markah*)

(b) Find a moment and force at point A and B for the beam subjected to uniformly distributed load, w.

Dapatkan momen dan daya pada titik A dan B untuk rasuk yang dikenakan beban teragih seragam, w.

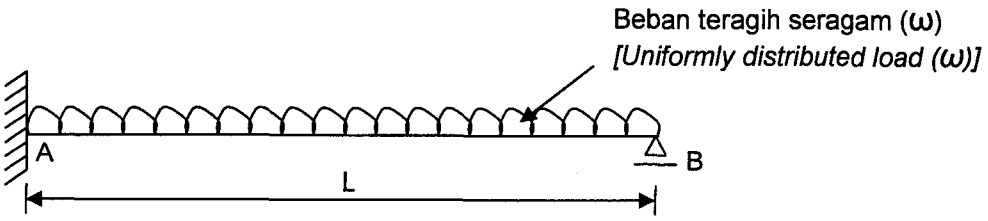


Figure 2.1/*Rajah 2.1*

(15 marks/*markah*)

3. (a) Compute the final deflection(mm) at midspan of the beam subjected to uniformly distributed load if L=8m, E=205kN/mm^2, I=87400cm^4, w=10kN/m.

Kira pesongan akhir di tengah rasuk yang dikenakan beban teragih seragam jika L =8m, E=205kN/mm^2, I= 87400cm^4, w=10kN/m.

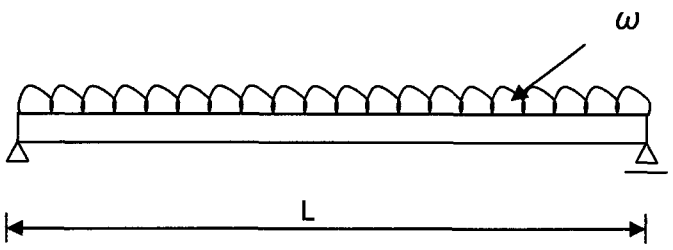


Figure 3/*Rajah 3*

(5 marks/*markah*)

(b) Express the deflection angle at point A and B in term of w, L, E and I for the beam subjected to uniformly distributed load

Given w : uniformly distributed load
L : span
E : modulus of elasticity
I : moment of inertia

Ungkapkan sudut pesongan di A dan B dalam bentuk w, L, E dan I untuk rasuk yang dikenakan beban teragih seragam.

Diberi w : beban teragih seragam
L : rentang
E : modulus elastik
I : moment sifat tekun

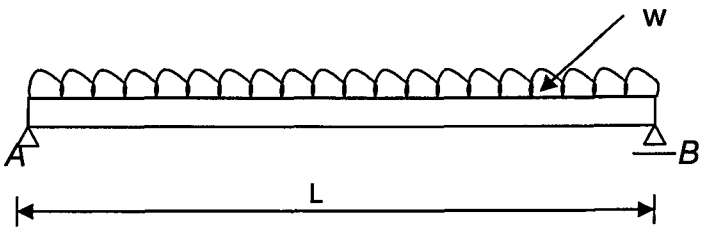


Figure 3.1/*Rajah 3.1*

(15 marks/*markah*)

4. A layout plan of a concrete slab is shown in **Figure 4**. Propose a suitable layout for supporting beams needed to support the solid slab and calculate the maximum positive and negative moments on the slab system. Assume that the Live Load is 2kN/m^2, weight of finishing is 0.75kN/m^2 and the thickness of slab is 200mm.

*Sebuah pelan tatatur struktur lantai konkrit diberikan dalam **Rajah 4**. Cadangkan tatatur rasuk yang diperlukan menggunakan sistem lantai pejal serta kirakan momen maksima positif dan negative pada lantai-lantai tersebut. Andaikan bahawa beban hidup adalah 2kN/m^2, berat lepaan adalah 0.75kN/m^2 dan tebal lantai adalah 200mm.*

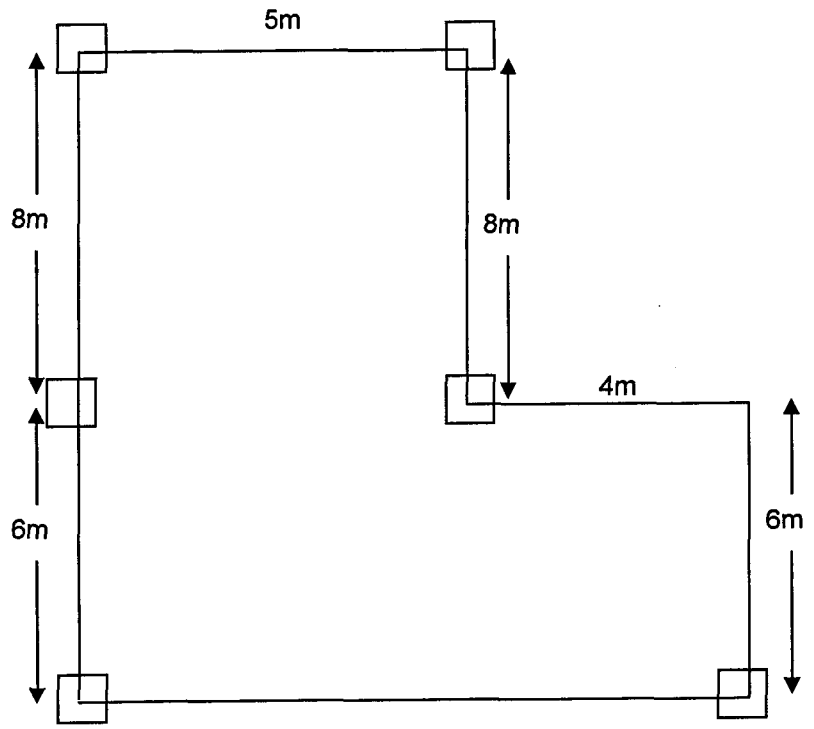


Figure 4/*Rajah 4*

(20 marks/*markah*)

5. (a) **Figure 5(a)** below shows a 3 span beam with a cantilever section. The cross section of each of the beam is shown in **Figure 5(b)**. Calculate the values and provide a diagram of maximum bending moments and shear forces for this beam system.

*Sebuah rasuk yang mempunyai 3 rentang serta bahagian julurnya ditunjukkan dalam **Rajah 5(a)** keratan lintang setiap rentang rasuk diberikan dalam **Rajah 5(b)**. Kira dan lukiskan gambarajah momen lentur dan daya ricih maksima yang berlaku dalam sistem rasuk tersebut.*

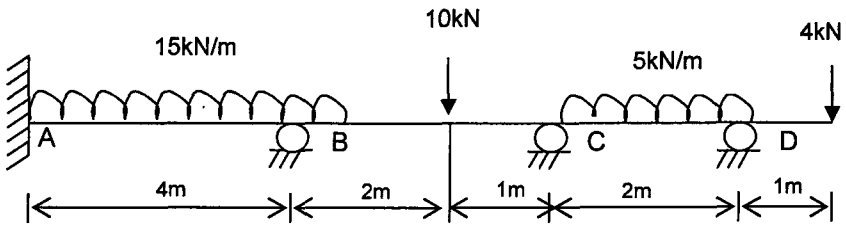
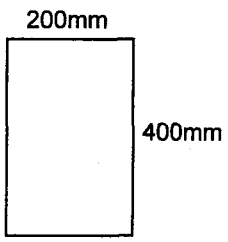
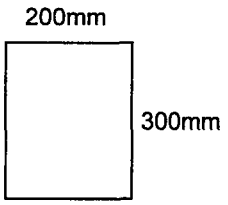


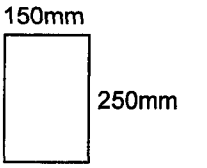
Figure 5(a)/*Rajah 5(a)*



Section for AB
(Bahagian untuk AB)



Section for BC
(Bahagian untuk BC)



Section for CD
(Bahagian untuk CD)

Figure 5(b)/*Rajah 5(b)*

(20 marks/*markah*)

(b) **Figure 6** shows a portal frame loaded with a uniformly distributed load and point load. Calculate and draw the bending moment and shear force diagram for all the members of the structure based on the sizes of members given in **Figure 6**. Assume a non-sway condition. Sketch the possible deflected shape of the structure.

*Sebuah kerangka "Portal" ditunjukkan yang dibebankan dengan beban seragam dan beban titik ditunjukkan dalam **Rajah 6**. Kirakan dan lukis gambarajah daya ricih dan momen lentur untuk kesemua ahli berdasarkan saiz keratan yang diberikan dalam **Rajah 6**. Anggapkan keadaan struktur tidak huyung. Lakarkan kecacatan yang boleh berlaku kepada kerangka tersebut.*

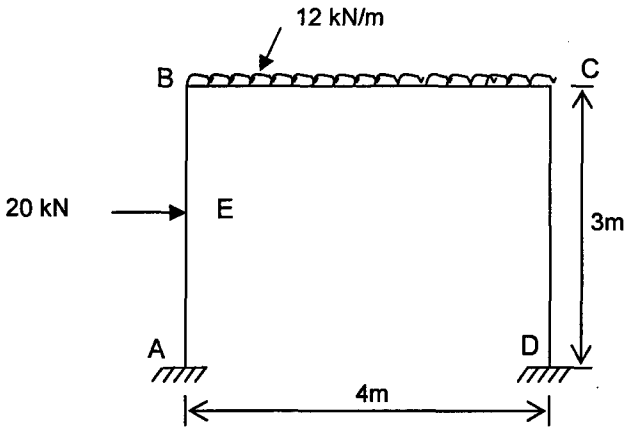
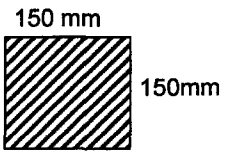
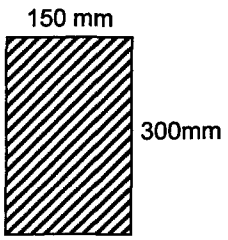


Figure 6(a)/*Rajah 6(a)*



Section for member AB and CD.
(Keratan lintang ahli AB dan CD)



Section for member BC.
(Keratan lintang ahli BC)

Figure 6(b)/*Rajah 6(b)*

(20 marks/*markah*)

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