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UNIVERSITI SAINS MALAYSIA

3<sup>rd</sup>. Semester Examination  
2002/2003 Academic Session  
*Peperiksaan Semester Tambahan (KSCP)*  
*Sidang Akademik 2002/2003*

April 2003

**EAS 253E/3 – Thoery of Structure**  
*EAS 253E/3 – Teori Struktur*

Duration: 3 hours

*Masa : 3 jam*

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**Instructions to candidates:**

1. Ensure that this paper contains **SEVEN (7)** printed pages.  
*1. Sila pastikan kertas peperiksaan ini mengandungi TUJUH (7) muka surat bercetak sebelum anda memulakan peperiksaan ini.*
2. This paper contains **SIX (6)** questions. Answer **SIX (6)** questions.  
*2. Kertas ini mengandungi ENAM (6) soalan. Jawab KESEMUA (6) soalan.*
3. All questions **CAN BE** answered in English or Bahasa Malaysia or combination of both languages.  
*3. Semua soalan boleh dijawab dalam Bahasa Inggeris atau Bahasa Malaysia ataupun kombinasi kedua-dua bahasa.*
4. Write the answered question numbers on the cover sheet of the answer script.  
*4. Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.*

1. (a) Determine the determinacy and the corresponding degree of indeterminacy where applicable for the following structures.

( 6 marks)

1. (a) Tentukan kebolehtentuan statik dan derajat ketidak-bolehtentuan statik (sekiranya berkaitan) untuk struktur-struktur di bawah:

( 6 markah)

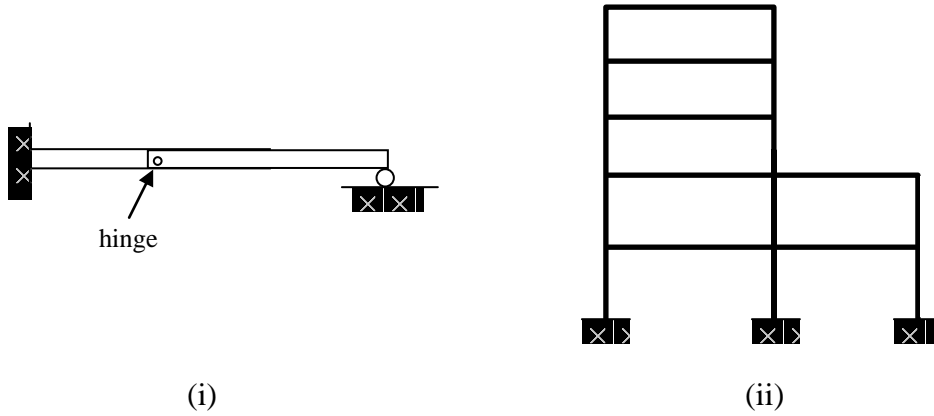


Figure 1

(b) Draw the shear and bending moment diagram for the frame shown in Figure 2.

(14 marks)

(b) Lukiskan gambarajah daya ricih dan momen lentur untuk kerangka yang ditunjukkan dalam Rajah 2.

(14 markah)

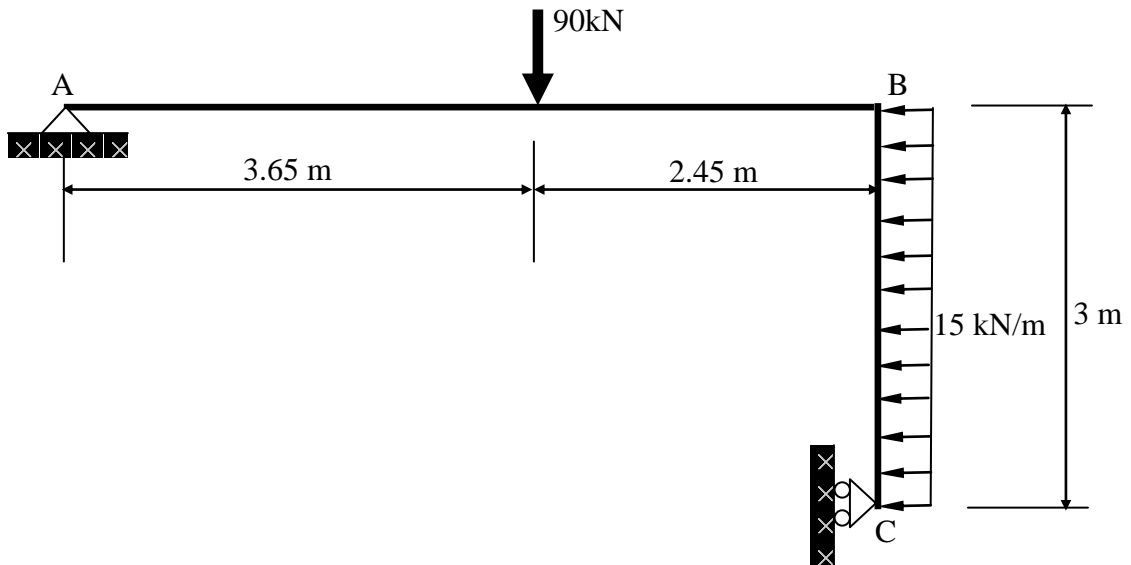


Figure 2

2. (a) Determine the member forces CE, CD and BD for the trusses shown in Figure 3 by the method of sections and classify whether they are in tension or compression.

( 9 marks)

- (a) *Kira daya dalam anggota kuda CE, CD dan BD dalam Rajah 3 menggunakan kaedah keratan. Nyatakan samada anggota tersebut mengalami daya mampatan atau tegangan.*

( 9 markah)

- (b) Find the member forces of AC and AB using joint to joint method. Classify whether they are in tension or compression.

( 6 marks)

- (b) *Dapatkan nilai daya dalam anggota AC dan AB menggunakan kaedah sambungan. Nyatakan samada anggota tersebut mengalami daya mampatan atau tegangan.*

( 6 markah)

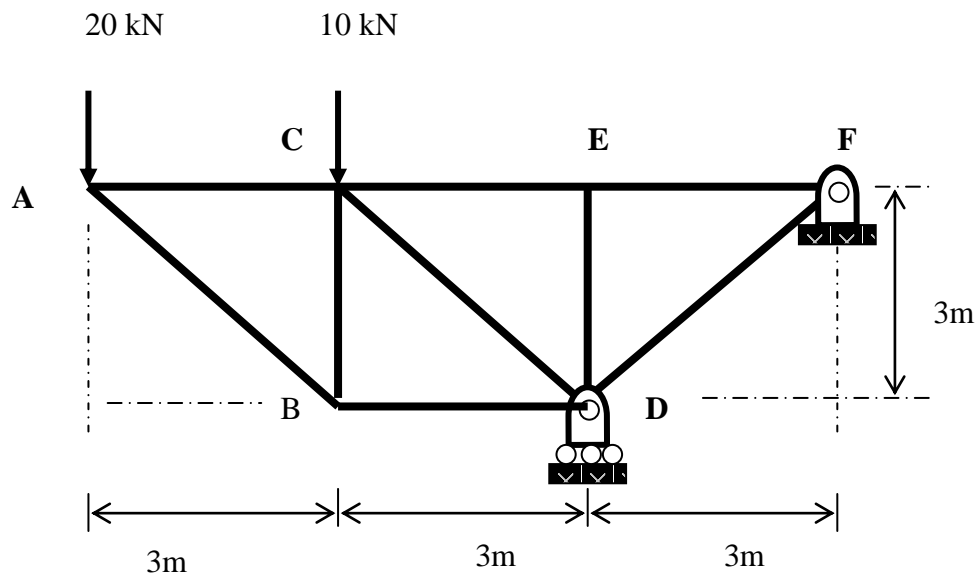


Figure 3

3. The cable system shown in Figure 4 is loaded with uniformly distributed load of 3kN/m between the supports (roller). The horizontal distance between supports is 50m and the vertical distance between the lowest point and the left hand support is 3m. The right hand support is 6m higher than the left support.

Determine:

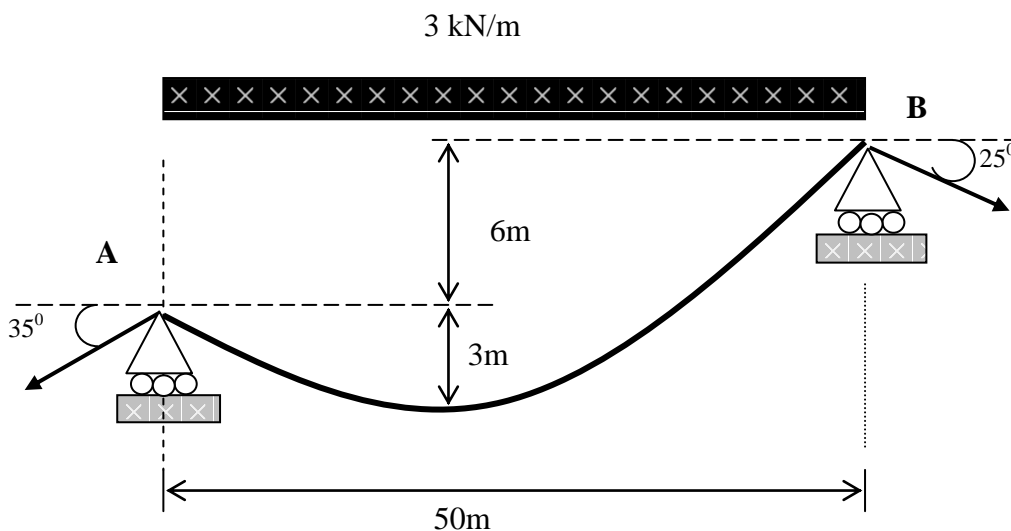
- (i) the total length of cable, given  $S = l_1 + l_2 + \frac{2d_1^2}{3l_1} + \frac{2d_2^2}{3l_2}$  and  $\frac{l_1}{l_2} = \sqrt{\frac{d_1}{d_2}}$
- (ii) the maximum and minimum tension between A and B.
- (iii) the tension in anchor cables.
- (iv) size of the cable, if the allowable stress = 14000 kN/m<sup>2</sup>.

(15 marks)

3. Satu sistem kabel seperti yang ditunjukkan dalam Rajah 4, digunakan untuk membawa beban teragih seragam sebanyak 3 kN/m disepanjang rentang antara kedua-dua penyokong berguling. Jarak ufuk antara penyokong ialah 50 m dan jarak menegak dari titik terbawah dan penyokong di sebelah kiri ialah 3m. Penyokong di sebelah kanan berada 6 m lebih tinggi daripada penyokong kiri.

Kira:

- (i) panjang keseluruhan kabel, diberi  $S = l_1 + l_2 + \frac{2d_1^2}{3l_1} + \frac{2d_2^2}{3l_2}$  dan  $\frac{l_1}{l_2} = \sqrt{\frac{d_1}{d_2}}$
- (ii) nilai tegangan maksima dan minima kabel antara penyokong A dan B.
- (iii) tegangan kabel sauh.
- (iv) saiz kabel yang diperlukan sekiranya tegasan kabel tersebut ialah 14000 kN/m<sup>2</sup>.



(15 marks)

Figure 4

4. A three pinned arch shown in Figure 5 is in the form of  $y = \frac{4hx(L-x)}{L^2}$ .

It is designed to carry a uniformly distributed load of 4 kN/m spanning 35m on BCDE and a point load of 6 kN and 10 kN at point B and D respectively. Joint A, C and E are hinged.

Determine:

- (i) support reactions at A and E.
- (ii) bending moment at B and D .
- (iii) shear force, Q and thrust, N at point D.

(15 marks)

4. Gerbang tiga engsel dalam Rajah 5 dibentuk dari persamaan  $y = \frac{4hx(L-x)}{L^2}$ .

Ia direkabentuk untuk membawa beban teragih seragam sebanyak 4 kN/m di sepanjang rentang 35m di bahagian BCDE dan beban tumpu 6 kN di titik B dan 10kN di titik D. Sambungan A, C dan E adalah engsel.

Cari:

- (i) daya tindakbalas di penyokong A dan E.
- (ii) momen lentur di titik B dan D.
- (iii) daya ricih, Q dan daya paksi N di titik D .

(15 markah)

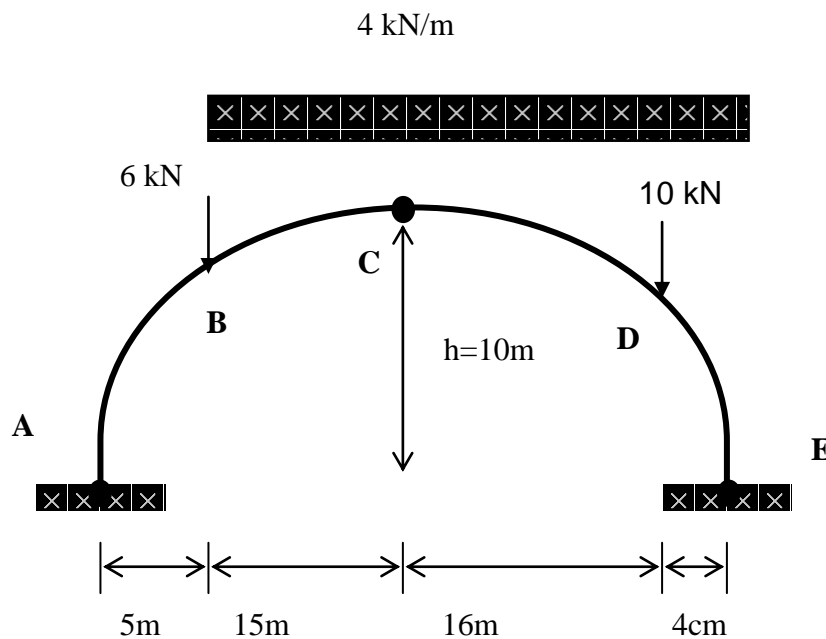


Figure 5

5. A beam ABCD is composed of two parts, ABC and CD the cantilever beam, as shown in Figure 6. Draw the influence line for and calculate:

- (i) the vertical reactions at supports A, and C.
- (ii) the shear just to the right of support C.
- (iii) the bending moment at point B, 4m away from support A.

(15 marks)

5. *Rasuk ABCD terdiri dari dua bahagian iaitu ABC dan CD rasuk terjulur seperti yang ditunjukkan dalam Rajah 6. Dengan menggunakan kaedah garis imbas, lakarkan dan dapatkan nilai bagi gambarajah garis imbas:*

- (i) *daya tindakbalas menegak di penyokong A dan C.*
- (ii) *daya ricih di bahagian kanan penyokong C.*
- (iii) *momen lentur di titik B iaitu 4m dari penyokong A.*

(15 markah)

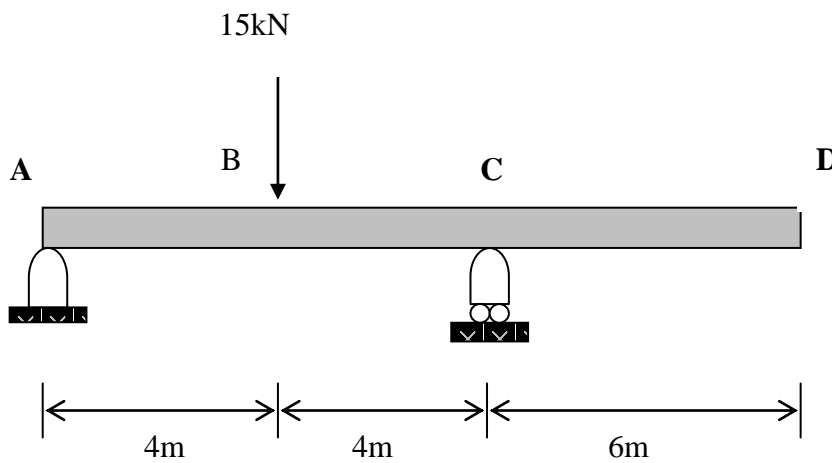


Figure 6

6. A pin jointed frame as shown in Figure 7 is required to carry point loads of 15kN at joints B and C.

Calculate the horizontal deflection at joint D. You may assume that all members are of the same size and having a similar E value, which is  $AE = 200 \times 10^3 \text{ kN}$ .

(20 marks)

6. Sebuah kerangka bersendi pin seperti yang ditunjukkan dalam Rajah 7, membawa beban tumpu sebesar 15kN di sendi B dan C.

Kira sesaran ufuk di sendi D. Anggap semua anggota mempunyai saiz nilai E yang sama iaitu  $AE = 200 \times 10^3 \text{ kN}$ .

(20 markah)

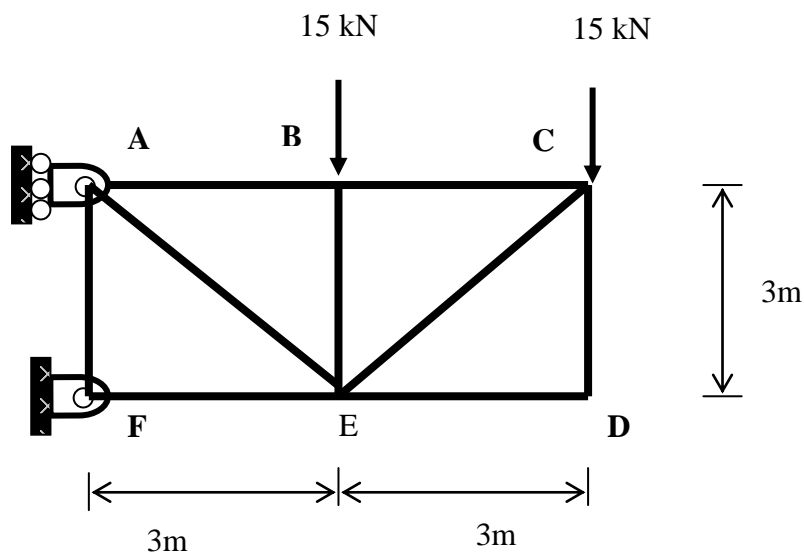


Figure 7

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