

**SULIT**

BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

**SESI DISEMBER 2014**

**CC601: STRUCTURAL ANALYSIS 2**

**TARIKH : 13 APRIL 2015**

**TEMPOH : 8.30AM – 10.30 AM (2 JAM)**

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Kertas ini mengandungi **EMPAT BELAS (14)** halaman bercetak.

Bahagian A: Pendek (10 soalan)

Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : **TIADA**

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**





**SECTION A : 40 MARKS**  
**BAHAGIAN A : 40 MARKAH**

**INSTRUCTION:**

This section consists of **TEN (10)** short questions. Answer **ALL**.

**ARAHAN :**

*Bahagian ini mengandungi **SEPULUH (10)** soalan pendek. Jawab **SEMUA** soalan.*

**QUESTION 1****SOALAN 1**

CLO1  
C1

State **TWO (2)** methods which are used to calculate internal force for truss structure.

*Nyatakan **DUA (2)** kaedah yang digunakan untuk mengira daya dalaman bagi struktur kekuda.*

(4 marks)

(4 markah)

**QUESTION 2****SOALAN 2**

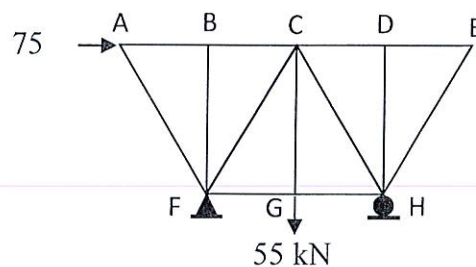
CLO1  
C2

Identify any **FOUR (4)** members of simply supported trusses in Figure A2 below which do not have internal forces (zero-bar).

*Kenalpasti mana-mana **EMPAT (4)** anggota kekuda sokong mudah dalam Rajah A2 di bawah yang tiada daya dalaman (zero-bar).*

(4 marks)

(4 markah)



**Figure A2 / Rajah A2**



**QUESTION 3****SOALAN 3**CLO1  
C1

Identify the vertical displacement at joint C of the truss in Figure A3, if member AB is 5 mm shorter.

*Kenalpasti ajakan pugak sendi C bagi kerangka dalam Rajah A3, jika ahli AB ialah 5 mm pendek.*

(4 marks)  
(4 markah)

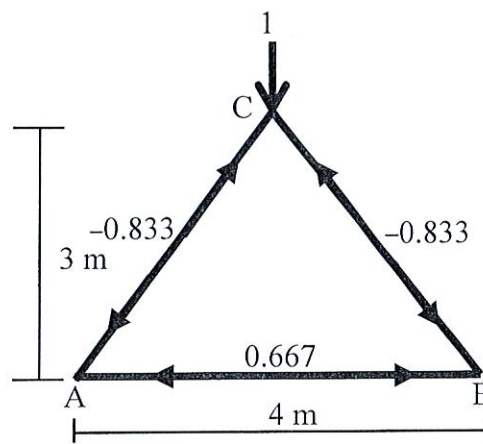


Figure A3/ Rajah A3

CLO2  
C2**QUESTION 4****SOALAN 4**

By referring to figure A4, determine the horizontal displacement of joint F, due to an increase in length of 0.015m for members AF and BC.

Merujuk kepada rajah A4, tentukan anjakan ufuk pada sendi F disebabkan oleh pertambahan panjang sebanyak 0.015m pada anggota AF dan BC.

(4 marks)

(4 markah)

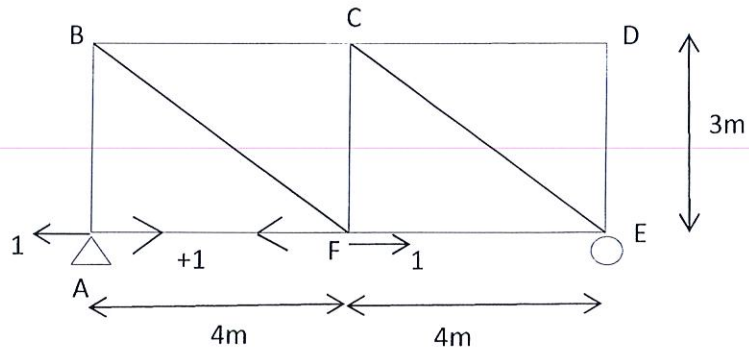


Figure A4/ Rajah A4

CLO1  
C2

**QUESTION 5**  
**SOALAN 5**

By referring to Figure A5(a) and Figure A5(b), determine whether the trusses below consist of internal surplus, external surplus or both internal and external surplus.

*Merujuk kepada Rajah A5(a) dan Rajah A5(b), tentukan sama ada kekuda tersebut mengandungi lebih luaran, lebih dalaman atau lebih luaran dan lebih dalaman.*

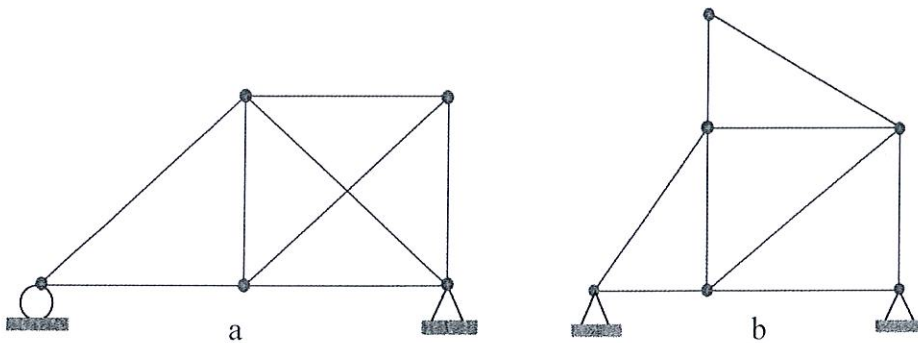


Figure A5 / Rajah A5

(4 marks)

(4 markah)

CLO1  
C3

## QUESTION 6

## SOALAN 6

By referring to Table A6 and Figure A6 below, calculate value of force ( $F$ ). The sectional areas,  $A$  and the modulus of elasticity,  $E$  are constant for all members.

Merujuk pada Jadual A6 dan Rajah A6 di bawah, kirakan nilai daya ( $F$ ). Luas keratan rentas,  $A$  dan modulus keanjalan,  $E$  adalah seragam untuk semua anggota.

(4 marks)  
(4 markah)

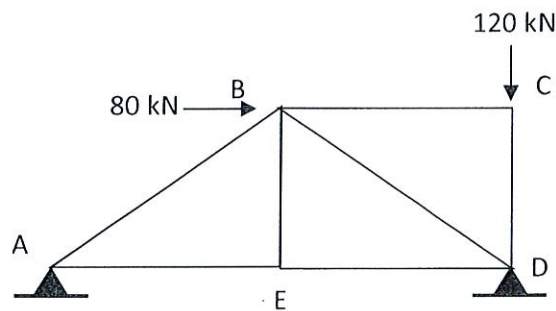


Figure A6 / Rajah A6

Member	P(kN)	u	L (m)	uPL	$U^2L$	$F = P + uR$
AB	50	0	5	0	0	
AE	-40	-1	4	160	4	
BC	0	0	4	0	0	
BD	-50	0	5	0	0	
BE	0	0	3	0	0	
CD	-120	0	3	0	0	
DE	-40	-1	4	160	4	
				320	8	

Table A6 / Jadual A6

CLO1  
C1**QUESTION 7**  
**SOALAN 7**

Draw the Influence Line Shear Force Diagram and the Influence Line Bending Moment Diagram at Point B for beam as shown in Figure A7.

Lakarkan Gambarajah Garis Imbas Daya Ricih dan Gambarajah Garis Imbas Momen Lentur pada Titik B bagi rasuk seperti ditunjukkan dalam Rajah A7.

(4 marks)

(4 markah)

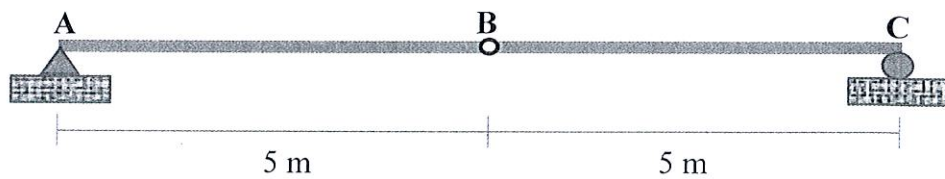


Figure A7/ Rajah A7

CLO2  
C2**QUESTION 8**  
**SOALAN 8**

Draw the influence line from the  $R_A$  and  $R_B$  reactions for the beam shown in Figure A8.

Lukis gambarajah garis imbas bagi tindakbalas  $R_A$  dan  $R_B$  untuk rasuk yang ditunjukkan pada Rajah A8.

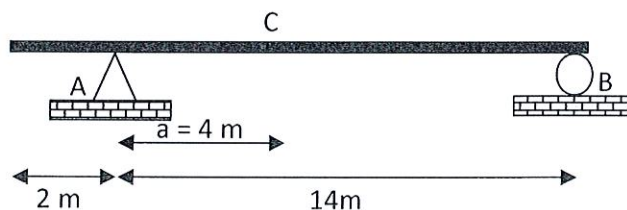


Figure A8 / Rajah A8

(4 marks)

(4 markah)



CLO3  
C2**QUESTION 9**  
**SOALAN 9**

By referring to the truss in Figure A9, sketch Influence Line Internal Force of EF including the values.

Merujuk kepada kerangka dalam Rajah A9, lakarkan Garis Imbas Daya Dalam bagi anggota EF termasuk nilai-nilainya.

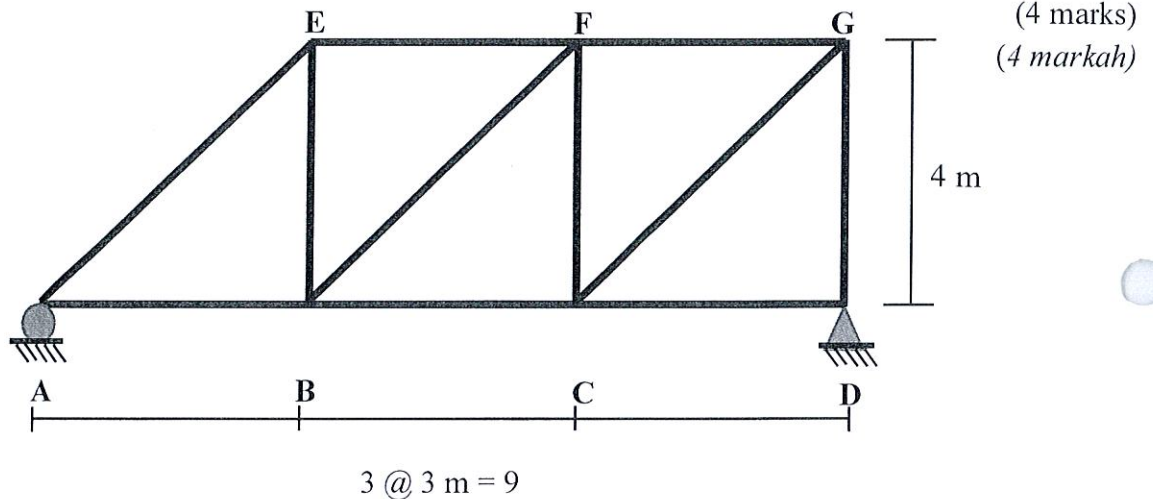


Figure A9/ Rajah A9

**QUESTION 10**  
**SOALAN 10**CLO1  
C3

Figure A10 shows The Influence Line Diagram for a member of truss. Calculate the maximum tension member due to concentrated load of 40 kN and uniformly distributed load of 80 kN/m along the span.

Rajah A10 menunjukkan Gambarajah Garis Imbas bagi satu anggota kekuda. Kirakan tegangan maksimum dalam anggota tersebut yang disebabkan satu beban tumpu dengan nilai 40 kN dan beban teragih seragam sebanyak 80 kN/m sepanjang rentang.

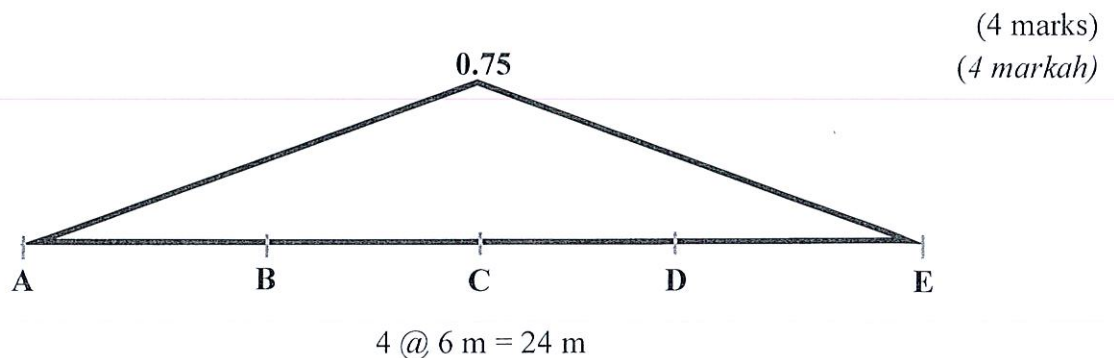


Figure A10/ Rajah A10



**SECTION B : 60 MARKS****BAHAGIAN B : 60 MARKAH****INSTRUCTION:**

This section consists of **FOUR (4)** structured questions. Answer **THREE (3)** questions only.

**ARAHAN :**

*Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab TIGA (3) soalan sahaja.*

**QUESTION 1****SOALAN 1**

Figure B1 shows a frame structure subjected to a horizontal load of 30kN at joint D and a vertical load of 10kN at joint C.

*Rajah B1 di bawah menunjukkan struktur kekuda yang dikenakan beban ufuk sebanyak 30kN pada sendi D dan beban pugak sebanyak 10kN pada sendi C.*

CLO1  
C2

(a) Calculate the reaction at support A and support B.

*Kirakan daya tindakbalas pada penyokong A dan penyokong B.*

[5 marks]

[5 markah]

CLO2  
C4

(b) Calculate the internal forces at joint B, C and A by using the method of joints.

*Kirakan daya dalaman pada sendi B, C dan A dengan menggunakan kaedah sendi.*

[10 marks]

[10 markah]

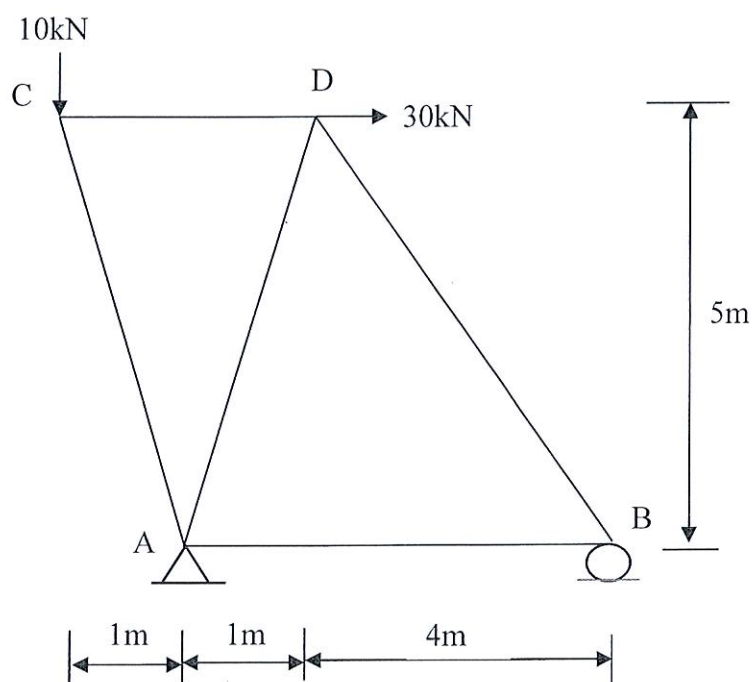
CLO2  
C5

- (c) Based on the answer in Question 1(b), develop a diagram of truss by showing internal forces including sign of force direction.

*Berdasarkan kepada jawapan Soalan 1(b), hasilkan gambarajah kekuda dengan menunjukkan nilai daya dalaman termasuk tanda arah daya.*

[5 marks]

[5 markah]



**Figure B1/Rajah B1**



## QUESTION 2

## SOALAN 2

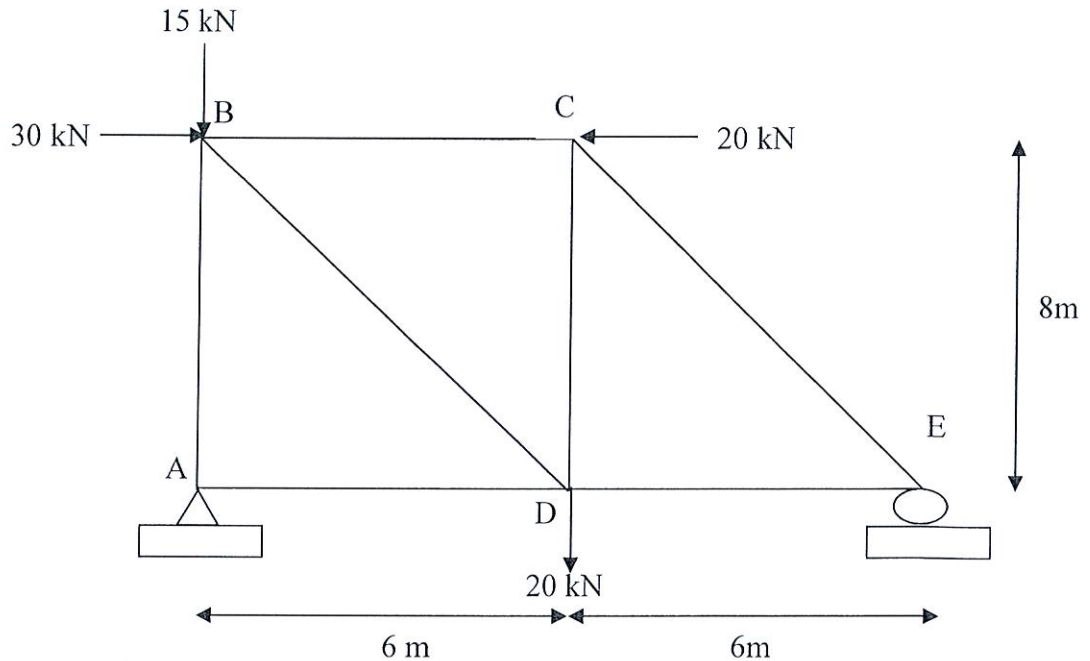


Figure B2 / Rajah B2

Figure B2 shows a frame structure subjected to a horizontal load of 30 kN at joint B, 20 kN at joint C and vertical load of 15 kN at joint B, 20 kN at joint D. Given cross sectional area,  $A = 20 \text{ cm}^2$  and modulus of elasticity,  $E = 200 \times 10^6 \text{ kN/m}^2$  in each member.

Rajah B2 menunjukkan struktur kerangka yang dikenakan beban ufuk sebanyak 30kN di sendi B, 20 kN di sendi C dan beban pugak sebanyak 15kN di sendi B, 20 kN di sendi D. Diberi luas keratan rentas,  $A = 20 \text{ cm}^2$  dan modulus keanjalan,  $E = 200 \times 10^6 \text{ kN/m}^2$  bagi setiap anggota.

CLO 1  
C3

- a) Calculate the reaction at support A and E

*Kirakan daya tindakbalas yang berlaku di tupang A dan E*

(3 marks)  
(3 markah)

CLO 1  
C4

- b) Calculate the internal force in each member of truss due to real loads.

*Kirakan daya dalaman bagi setiap anggota kekuda yang disebabkan oleh beban sebenar.*

(7 marks)  
(7markah)

CLO 1  
C4

- c) Compute the internal force in each member of the truss due to a horizontal virtual unit loads at joint C.

*Kirakan daya dalaman bagi setiap anggota kekuda disebabkan oleh beban satu unit ufuk pada sendi C.*

(7marks)  
(7 markah)

CLO 2  
C5

- d) From the answer of internal forces due to real loads and virtual unit loads, generate the horizontal displacements of joint C.

*Daripada nilai daya dalaman disebabkan oleh daya sebenar dan beban satu unit pugak, hasilkan anjakan ufuk pada sendi C.*

(3 marks)  
(3 markah)



## QUESTION 3

## SOALAN 3

A simply supported trusses is imposed with a vertical and horizontal load as shown in Figure B3. Given the reactions in joints F,  $V_F = 31\text{kN}$  and reaction on the joints A,  $V_A = -6\text{kN}$  and  $H_D = -9\text{kN}$  as shown in the figure. Given the cross-sectional area and modulus of elasticity is constant for each member of the truss.

*Kekuda disokong mudah dikenakan beban tumpu mengufuk dan pugak seperti ditunjukkan dalam Rajah B3. Diberi daya tindakbalas pada sendi F,  $V_F = 31\text{kN}$  dan daya tindakbalas pada sendi A,  $V_A = -6\text{kN}$  dan  $H_D = -9\text{kN}$  seperti yang ditunjukkan dalam rajah. Diberi luas keratan rentas dan modulus keanjalan adalah malar bagi setiap anggota kekuda.*

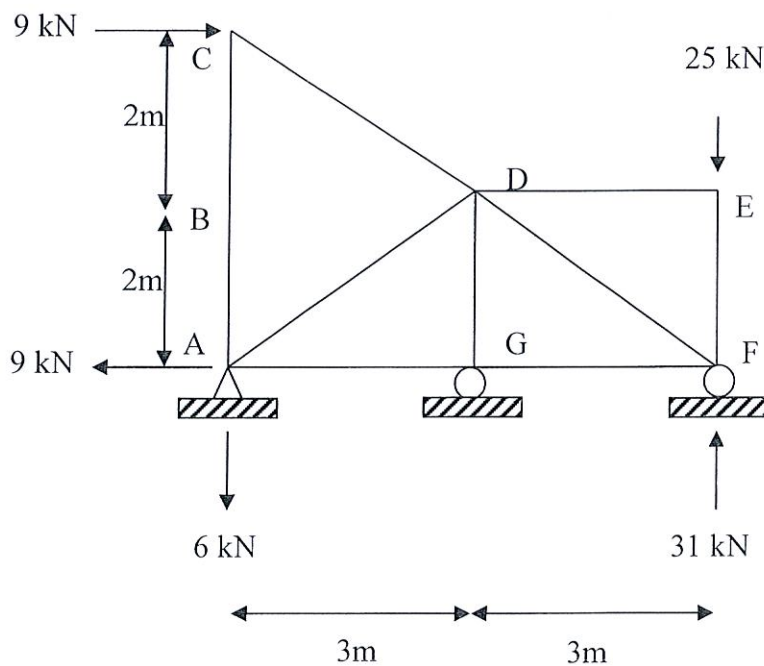


Figure B3 / Rajah B3

CLO1  
C4

- a) Select reaction G as redundant, then analyse the internal forces for each member of the truss.

*Pilih tindakbalas G sebagai lebih, kemudian analisa daya dalaman bagi setiap anggota kekuda.*

(6 marks)

(6 markah)

CLO1  
C3

- b) Calculate the internal force for all truss members due to the unit load at support G.

*Kirakan daya dalaman bagi semua anggota kekuda disebabkan oleh beban unit pada sokong G.*

(6 marks)

(6 markah)

CLO2  
C5

- c) Rearrange the forces value by developing a table to determine the member of redundant, R.

*Susun semula nilai daya dengan membangunkan jadual untuk menentukan anggota lebih, R.*

(6 marks)

(6 markah)

CLO2  
C5

- d) Produce the actual force in all members of the truss by using the member of redundant R.

*Hasilkan daya dalaman bagi semua anggota kekuda dengan menggunakan anggota lebih, R.*

(2 marks)

(2 markah)



**QUESTION 4/ SOALAN 4**

A simply supported beam with 50 m span with point load load as Figure B4. The moving load moved from A to B with 120 kN point load leading.

*Rasuk disokong mudah dengan panjang rentang 50 m dikenakan beban tumpu seperti Rajah B4. Beban bergerak dari A ke B dengan beban tumpu 120kN mendahului.*

CLO2  
C2

- a) Calculate the resultant force of the load series.  
*Kirakan daya paduan bagi satu siri beban tumpu tersebut.*

(2 marks)  
(2 markah)

CLO2  
C2

- b) Compute the location of the Resultant Force.  
*Tentukan kedudukan Daya Paduan.*

(3 marks)  
(3 markah)

CLO2  
C3

- c) Calculate the Absolute Maximum Moment due to the moving concentrated load series.  
*Tentukan Momen Maksima Mutlak yang disebabkan oleh satu beban siri yang bergerak itu.*

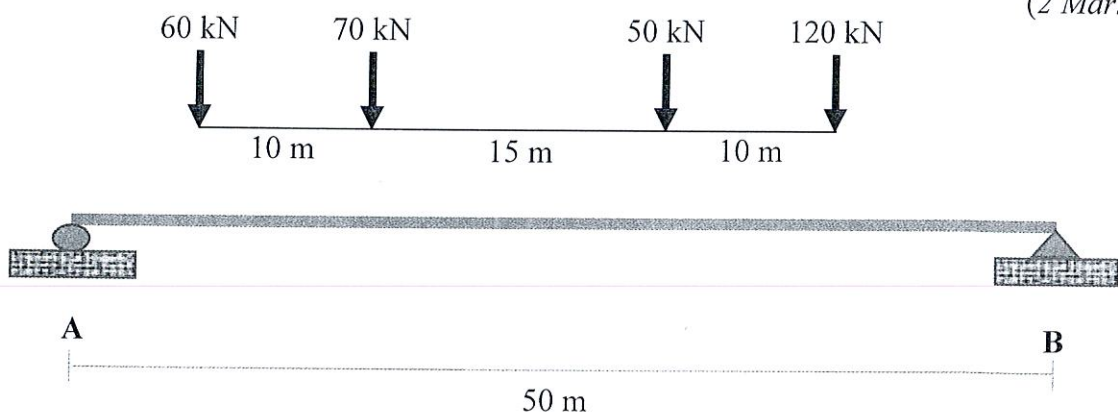
(13 marks)  
(13 Markah)

CLO2  
C5

- d) Based on the answer in Question 4(c), explain the importance of Absolute Maximum Moment.

*Berdasarkan jawapan Soalan 4(c), terangkan kepentingan Momen Maksima Mutlak.*

(2 marks)  
(2 Markah)



**Figure B4/ Rajah B4**

**SOALAN TAMAT**

