

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR**

**SESI DISEMBER 2015**

**CC505 : STRUCTURAL ANALYSIS 1**

**TARIKH : 7 APRIL 2016**

**MASA : 8.30 AM – 10.30 AM (2 JAM)**

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**Kertas ini mengandungi TUJUH BELAS (17) halaman bercetak.**

**Bahagian A: Soalan Pendek (10 soalan)**

**Bahagian B: Struktur (4 soalan)**

**Dokumen sokongan yang disertakan : Formula**

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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 questions.

## ARAHAN :

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

## CLO1 QUESTION 1

## C1 SOALAN 1

Identify whether the structure in Figure A1 is statically determinate or statically indeterminate.

Kenalpasti sama ada struktur dalam Rajah A1 boleh tentu secara statik atau tidak boleh tentu secara statik.

[4 marks]

[4 markah]

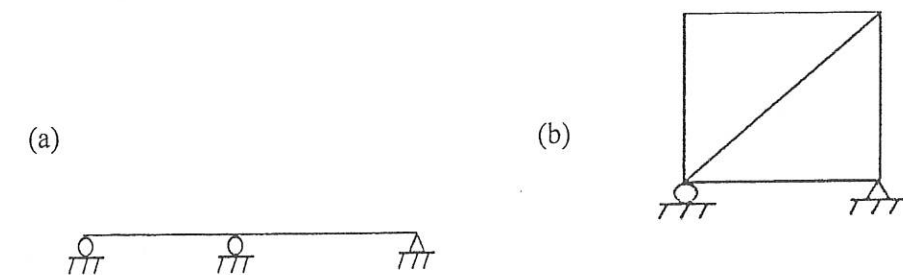


Figure A1 / Rajah A1

QUESTION 2

SOALAN 2

CLO1  
C2

Calculate the reaction at support B for the beam shown in Figure A2 by using Superposition Method. Given the value of  $Y_A^1 = 15,864.19/EI$ .

Kirakan daya tindakbalas pada tumpang B bagi rasuk yang ditunjukkan dalam Rajah A2 dengan menggunakan Kaedah Tindihan. Diberi nilai  $Y_A^1 = 15,864.19/EI$ .

[4 marks]

[4 markah]

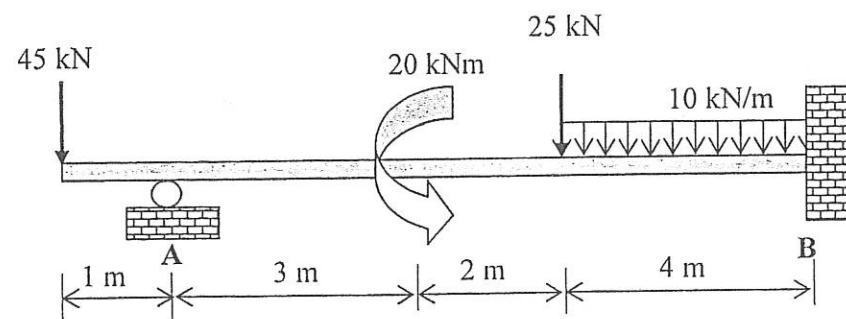


Figure A2/Rajah A2

QUESTION 3

SOALAN 3

CLO1  
C3

Calculate the constant value for  $C_1$  and  $C_2$  from Slope Deflection Equations ( $EI \frac{dy}{dx}$  and  $EI y$ ) for cantilever indeterminate beam as shown in Figure A3. Given :

Kirakan pemalar  $C_1$  dan  $C_2$  dari persamaan cerun pesongan ( $EI \frac{dy}{dx}$  dan  $EI y$ ) bagi rasuk julur tak boleh tentu seperti yang ditunjukkan dalam Rajah A3. Diberi :

$$EI \frac{d^2y}{dx^2} = -4(x-5)^2 - 3(x)^2 + 3(x-2)^2 - 7(x-3)$$

$$EI \frac{dy}{dx} = -\frac{4(x-5)^3}{3} - \frac{3(x)^3}{3} + \frac{3(x-2)^3}{3} - \frac{7(x-3)^2}{2} + C_1$$

$$EI y = -\frac{4(x-5)^4}{12} - \frac{3(x)^4}{12} + \frac{3(x-2)^4}{12} - \frac{7(x-3)^3}{12} + C_1(x) + C_2$$

[4 marks]

[4 markah]

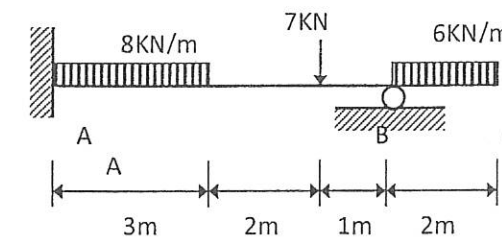


Figure A3 / Rajah A3

CLO1  
C1

QUESTION 4  
SOALAN 4

State the Moment Equation for the indeterminate beam shown in Figure A4 by using the Slope Deflection Method. Given the value of Fixed End Moment below:

Nyatakan Persamaan Momen bagi rasuk tidak boleh tentu bagi Rajah A4 dengan menggunakan Kaedah Cerun Pesongan. Diberi nilai Momen Hujung Terikat seperti di bawah:

$$M^F_{AB} = -60 \text{ kNm}$$

$$M^F_{BC} = -13.333 \text{ kNm}$$

$$M^F_{BA} = 60 \text{ kNm}$$

$$M^F_{CB} = 13.333 \text{ kNm}$$

[4 marks]

[4 markah]

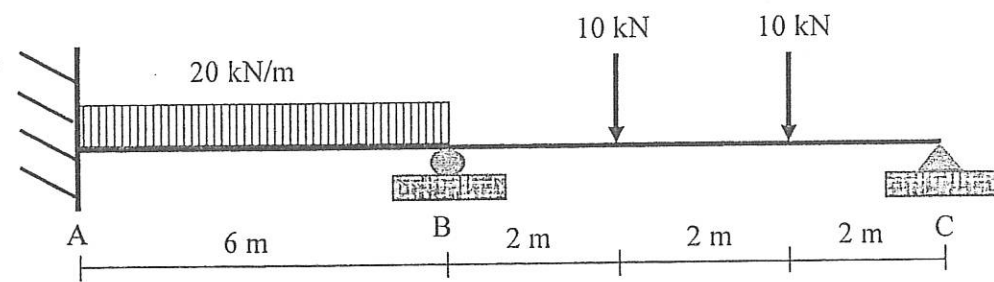


Figure A4/ Rajah A4

CLO1  
C2

QUESTION 5  
SOALAN 5

In Figure A5, the two-span continuous beam is subjected to a point load and uniform distributed load. Determine the fixed end moments for each span.

Dalam Rajah A5, rasuk selanjur dua rentang dikenakan beban tumpu dan beban teragih seragam. Tentukan momen hujung terikat bagi setiap rentang.

[4 marks]

[4 markah]

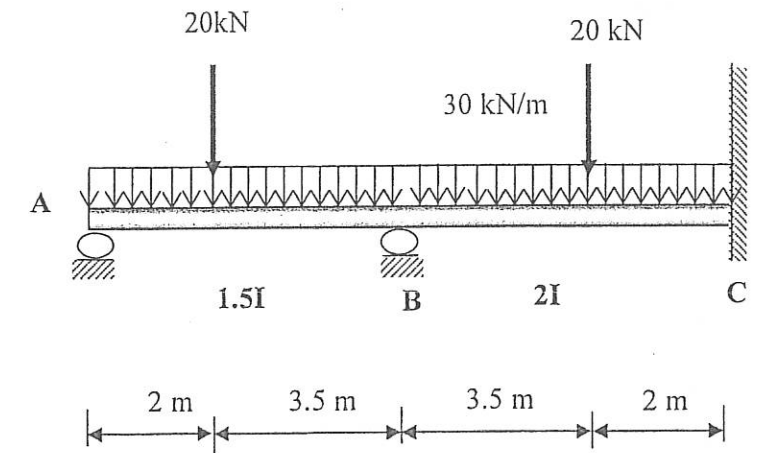


Figure A5/Rajah A5

QUESTION 6  
SOALAN 6

CLO1  
C2

Determine the equilibrium conditions for the portal frame shown in Figure A6.

Tentukan keadaan keseimbangan untuk kerangka portal yang ditunjukkan dalam Rajah A6.

[4 marks]

[4 markah]

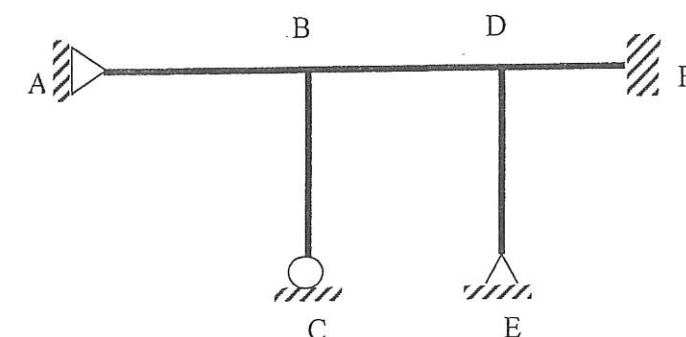


Figure A6 / Rajah A6

QUESTION 7  
SOALAN 7

CLO1  
C3

Figure A7 shows the frame with pinned at A and C. Calculate the fixed end moment for portal frame.

Rajah A7 menunjukkan satu kerangka yang diikat pin di hujung A dan C. Kirakan momen hujung terikat untuk kerangka portal.

[4 marks]  
[4 markah]

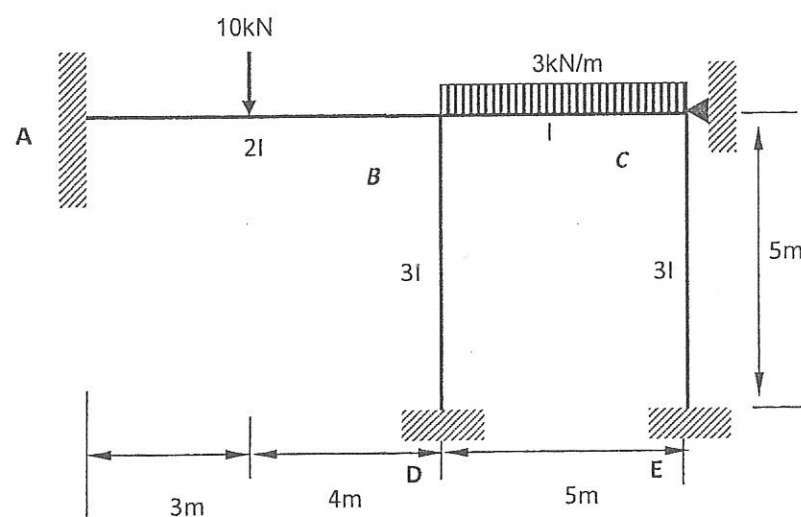


Figure A7/Rajah A7

QUESTION 8  
SOALAN 8

CLO 1  
C1

Based on Figure A8, identify the stiffness factor when uniform distributed load is applied on the beam.

Berdasarkan Rajah A8, kenalpasti faktor kekukuhan di mana rasuk dikenakan beban teragih seragam sahaja.

[4 marks]  
[4 markah]

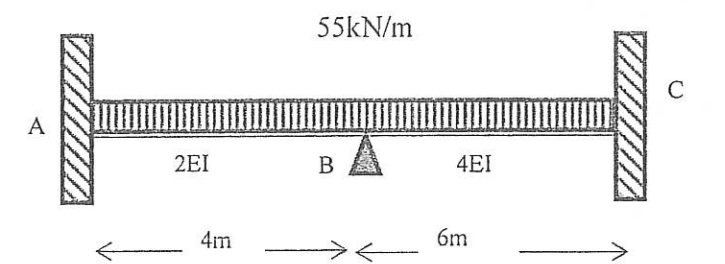


Figure A8 / Rajah A8

QUESTION 9  
SOALAN 9

CLO1  
C2

Calculate the moment distribution as listed in Table A9 until FOUR (4) cycles of balance, without calculating to end moments.

Kirakan momen agihan pada Jadual A9 sehingga EMPAT (4) kitaran agihan tanpa mengira momen akhir

[4 marks]  
[4 markah]

Table A9 / Jadual A9

JOINT	A	B	C	D
MEMBERS	AB	BA	BC	CB
DF	0	5/7	2/7	1
FEM	-54.67	+54.67	-5.76	+8.64

## QUESTION 10

## SOALAN 10

CLO1  
C2

Differentiate **TWO (2)** conditions between non-sway and sway portal frame.

*Bezakan DUA(2) keadaan di antara kerangka portal hujung dan kerangka tidak hujung.*

( 4 marks )

( 4 markah )

## 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

A continuous beam ABC is subjected to point load and distributed load as shown in **Figure B1**. By using the Slope Deflection Method, assuming the EI value is constant at each span along the beam and no settlement occurred :

*Satu rasuk selangar ABC dikenakan beban teragih seragam dan beban tumpu seperti yang ditunjukkan dalam Rajah B1. Dengan menggunakan Kaedah Cerun Pesongan, anggap nilai EI adalah malar sepanjang rasuk dan tiada enapan yang berlaku:*

CLO1  
C2

(a) Calculate the fixed end moment

*Kirakan momen hujung terikat*

[3 marks]

*[3 markah]*CLO1  
C2

(b) Determine the slope deflection equations

*Tentukan persamaan cerun pesongan*

[4 marks]

*[4 markah]*

CLO1  
C3 (c) Calculate the end moments at each support  
*Kirakan momen akhir pada setiap tumpang*

[6 marks]  
[6 markah]

CLO1  
C3 (d) Calculate the reaction force at each support  
*Kirakan daya tindakbalas pada setiap tumpang*

[4 marks]  
[4 markah]

CLO1  
C3 (e) Sketch the bending moment diagram  
*Lakarkan gambarajah momen lentur*

[3 marks]  
[3 markah]

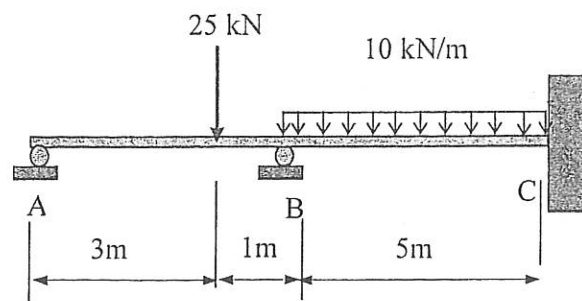


Figure B1/Rajah B1

QUESTION 2  
SOALAN 2

A portal frame is subjected to loads as shown in Figure B2. By using Slope Deflection Method.

Kerangka portal dikenakan beban seperti ditunjukkan dalam Rajah B2. Dengan menggunakan Kaedah Cerun Pesongan.

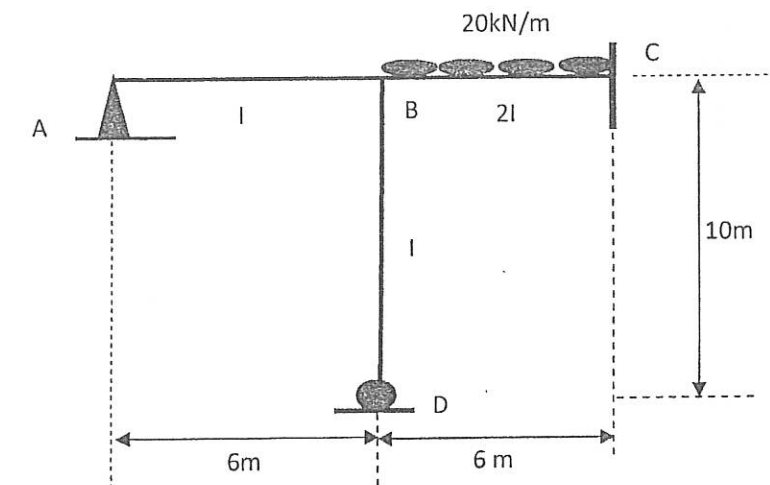


Figure B2/Rajah B2

CLO1  
C3 (a) Calculate the Slope Deflection Equation.  
*Kirakan persamaan cerun pesongan*

[6 marks]  
[6 markah]

CLO1  
C3 (b) Interpret the boundary condition for each support.  
*Tafsirkan keadaan persempadanan bagi setiap penyokong*

[4 marks]  
[4 markah]

CLO1  
C3 (c) Calculate The value of slope deflection angle,  $\theta$  and internal moment for portal frame.

*Kirakan nilai sudut pesongan,  $\theta$  dan momen dalaman bagi kerangka portal*  
[10 marks]  
[10 markah]

## QUESTION 3

## SOALAN 3

An indeterminate beam is subjected to a point load of 20 kN and uniformly distributed load of 10 kN/m along the span as shown in **Figure B3**. By using usual distribution of Moment Distribution Method :

*Satu rasuk tidak boleh tentu dikenakan beban tumpu sebanyak 20 kN dan beban teragih seragam sebanyak 10kN/m di sepanjang rentang seperti di tunjukkan dalam Rajah B3. Dengan menggunakan agihan biasa bagi Kaedah Agihan Momen:*

- CLO1  
C2
- i. Calculate the value of fixed end moment,  $M^F$  at each support.  
*Kirakan nilai momen hujung terikat,  $M^F$  pada setiap penyokong.*
- [4 marks]  
[4 markah]
- CLO1  
C2
- ii. Identify the stiffness factor,  $K$  and the distribution factor,  $DF$  at each span.  
*Nyatakan faktor kekukuhan,  $K$  dan Faktor Agihan,  $FA$  pada setiap rentang.*
- [5 marks]  
[5 markah]
- CLO1  
C3
- iii. Calculate the value of final moment at all support.  
*Kirakan nilai momen akhir pada semua penyokong.*
- [7 marks]  
[7 markah]
- CLO1  
C3
- iv. Calculate the value of reaction force at Support A, B and C.  
*Kirakan nilai daya tindak balas pada penyokong A, B dan C.*
- [4 marks]  
[4 markah]

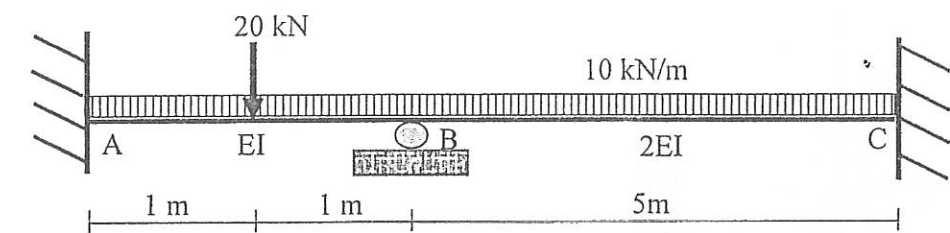


Figure B3/ Rajah B3

## QUESTION 4

## SOALAN 4

A portal frame without sway is shown in **Figure B4**. By using Moment Distribution Method calculate :-

CLO1  
C3

*Kerangka portal tanpa huyung dibebankan seperti dalam Rajah B4. Dengan menggunakan Kaedah Agihan Momen, kirakan :-*

- a) Fixed end moments for every member  
*Momen hujung terikat setiap anggota*
- [5 marks]  
[5 markah]
- b) Stiffness Value And Distribution Factor  
*Nilai kekukuhan dan faktor agihan*
- [6 marks]  
[6 markah]
- c) Final moment value ( 4 times distribution )  
*Momen Akhir untuk kerangka portal ( 4 kali agihan )*
- [9 marks]  
[9 markah]



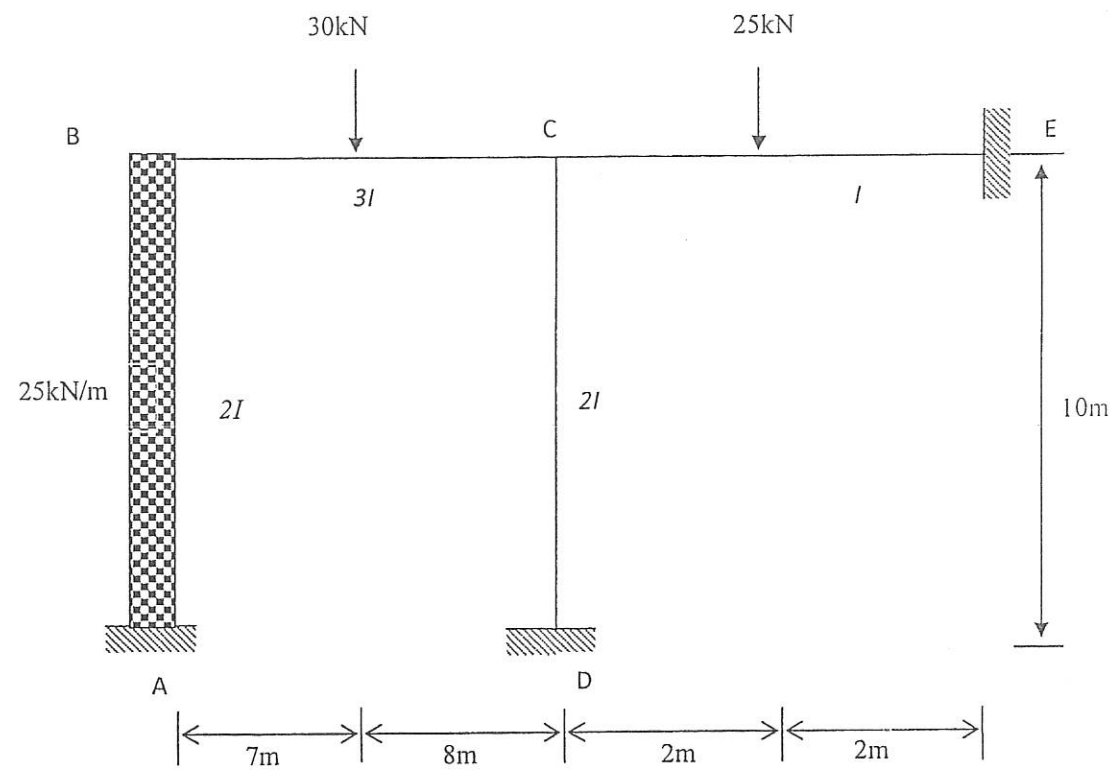


Figure B4 / Rajah B4

-SOALAN TAMAT-

CC 505 – ANALYSIS STRUCTURAL  
FORMULA

1. Slope Deflection Method

$$M_{AB} = 2EI/L (2\theta_A + \theta_B - 3\delta/L) + FEM_{AB}$$

$$M_{BA} = 2EI/L (2\theta_B + \theta_A - 3\delta/L) + FEM_{BA}$$

2. Moment Distribution Method

$$\text{Settlement Moment} = \frac{6EI\Delta}{L^2} @ \frac{3EI\Delta}{L^2}$$

Table 1 : Fixed End Moment (FEM)

$FEM_{AB} = \frac{-wL^2}{12}$		$FEM_{BA} = \frac{+wL^2}{12}$
$FEM_{AB} = \frac{-wL}{8}$		$FEM_{BA} = \frac{+wL}{8}$
$FEM_{AB} = \frac{-Wab^2}{L^2}$		$FEM_{BA} = \frac{+Wa^2b}{L^2}$