

**SULIT**



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

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR**

**SESI JUN 2016**

**CC505: STRUCTURAL ANALYSIS 1**

**TARIKH : 22 OKTOBER 2016**

**TEMPOH : 11.15 AM – 1.15 PM (2 JAM)**

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Kertas ini mengandungi **ENAM BELAS (16)** halaman bercetak.

Bahagian A: Soalan Pendek (10 soalan)

Bahagian B: Soalan 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  
C1

## QUESTION 1

## SOALAN 1

Figure A1 shows a 7m length propped cantilever beam with 8kN and 5kN point loads. By using the Superposition Method, draw the deflection curve for:

Rajah A1 ialah 7m rasuk julur bersangga dengan beban tumpu 8kN dan 5kN. Menggunakan Kaedah Tindihan, lukiskan garisan lenturan bagi:

(a) Case 1: support removed

Kes 1: Penyokong disingkirkan

(b) Case 2: load removed

Kes 2: Beban disingkirkan

[4 marks]

[4 markah]

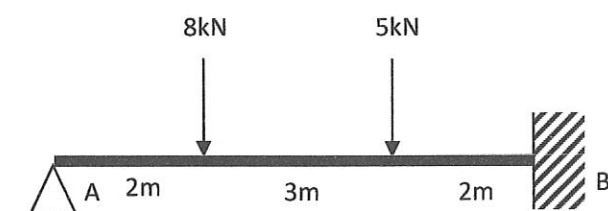


Figure A1

Rajah A1

CLO1  
C2

## QUESTION 2

## SOALAN 2

Figure A2 shows a propped cantilever beam with two point loads. By using the two equations given, calculate the value for  $C_1$  and  $C_2$ .

Rajah A2 menunjukkan satu rasuk julus bersokong dengan dua beban tumpu.

Berpandukan dua persamaan yang diberi, kirakan nilai  $C_1$  dan  $C_2$ .

$$EI \frac{dy}{dx} = \frac{-8[x-3]^2}{2} - \frac{5[x-1.5]^2}{2} + C_1$$

$$EIy = \frac{-8[x-3]^3}{6} - \frac{5[x-1.5]^3}{6} + C_1x + C_2$$

[4 marks]

[4 markah]

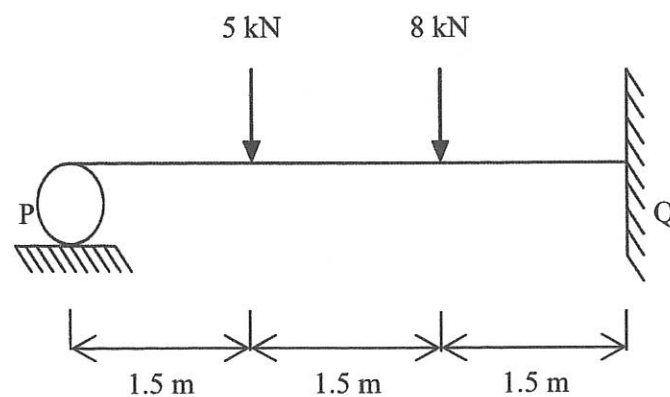


Figure A2

Rajah A2

CLO1  
C3

## QUESTION 3

## SOALAN 3

Calculate the value of reaction at B for the indeterminate beam shown in Figure A3.

Given value of deflection at support B is  $\frac{-11413.37}{EI}$ .

Kirakan nilai tindakbalas pada sokong B untuk rasuk tidak boleh tentu bagi Rajah

A3. Diberi nilai pesongan pada sokong B ialah  $\frac{-11413.37}{EI}$ .

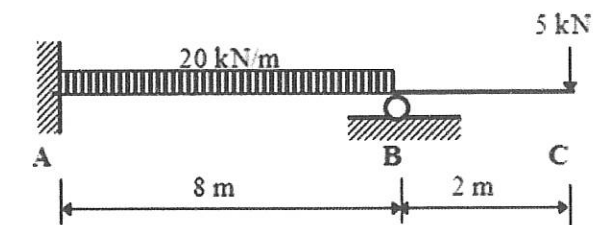


Figure A3

Rajah A3

[4 marks]

[4 markah]

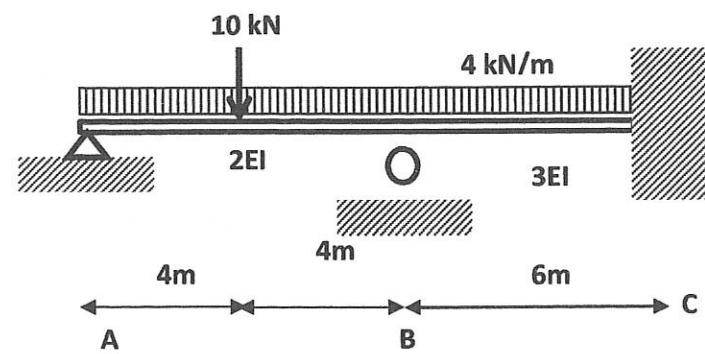
CLO1  
C1

**QUESTION 4**  
**SOALAN 4**

Using Slope Deflection Method, write the slope deflection equations for indeterminate beam as shown in **Figure A4**. Given value of the Fixed End Moment for continuous beam as below:

Dengan menggunakan Kaedah Cerun Pesongan, tuliskan persamaan cerun pesongan bagi rasuk tak boleh tentu seperti yang ditunjukkan dalam **Rajah A4**. Nilai Momen Hujung Terikat bagi rasuk selanjur adalah seperti berikut:

$$\begin{aligned} FEM_{AB} &= -31.33 \text{ kNm} & FEM_{BC} &= -12 \text{ kNm} \\ FEM_{BA} &= +31.33 \text{ kNm} & FEM_{CB} &= +12 \text{ kNm} \end{aligned}$$



**Figure A4**  
**Rajah A4**

[4 marks]  
[4markah]

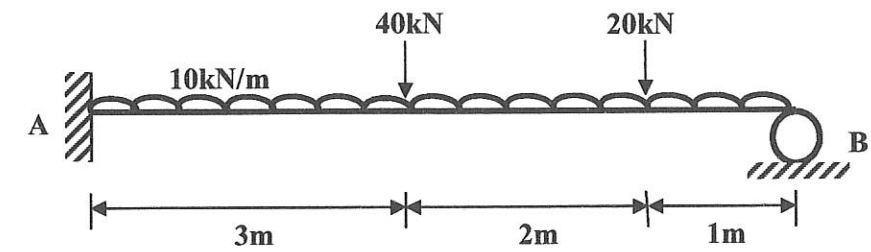
CLO1  
C2

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

Calculate the Fix End Moment for beam in **Figure A5** below.

Kirakan Momen Hujung Terikat bagi rasuk dalam **Rajah A5** di bawah.

[4 marks]  
[4 markah]



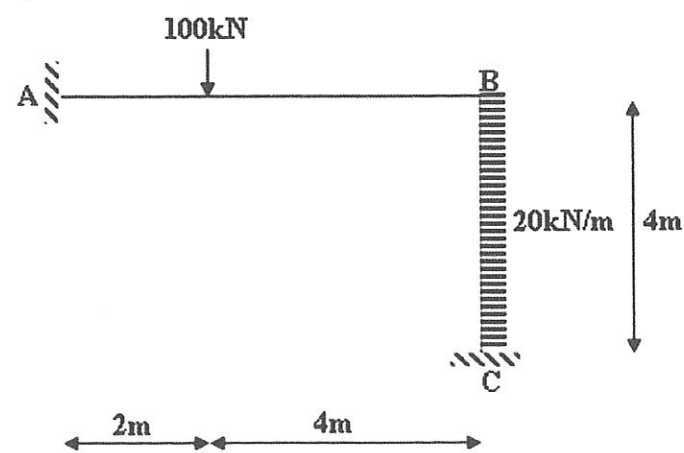
**Figure A5**  
**Rajah A5**

CLO1  
C2**QUESTION 6**  
**SOALAN 6**

A portal frame is subjected to uniformly distributed load 20kN/m and point load 100kN as shown in **Figure A6**. Determine the slope deflection equations by using the fixed end moments given.

Satu kerangka portal dikenakan beban teragih seragam 20kN/m dan beban tumpu 100kN seperti yang ditunjukkan di dalam **Rajah A6**. Tentukan persamaan cerun pesongan dengan menggunakan nilai momen hujung terikat yang diberi.

$$\begin{aligned} M_{AB}^F &= -88.9 \text{ kNm} \\ M_{BA}^F &= 44.4 \text{ kNm} \\ M_{BC}^F &= -26.7 \text{ kNm} \\ M_{CB}^F &= 26.7 \text{ kNm} \end{aligned}$$



**Figure A6**  
**Rajah A6**

[4 marks]

[4 markah]

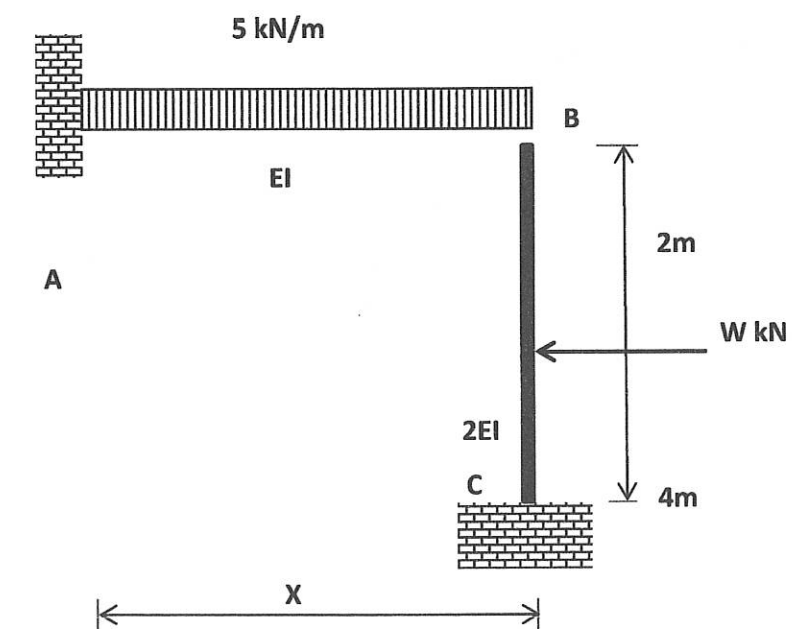
CLO1  
C3**QUESTION 7**  
**SOALAN 7**

Based on the information given in **Table A7** and **Figure A7**, calculate the value of  $W$  and  $X$ . Frame AB is subjected to uniformly distributed load (UDL) of 5 kN/m and point load of  $W$  kN at frame BC.

Berdasarkan kepada maklumat yang diberi dalam **Jadual A7** dan **Rajah A7**, kirakan nilai bagi  $W$  dan  $X$ . Kerangka AB dikenakan beban teragih seragam 15 kN/m manakala beban tumpu sebanyak  $W$  kN dikenakan pada kerangka BC.

**Table A7****Jadual A7**

Span	AB	BA	BC	CB
FEM (kNm)	-26.67	26.67	-17.8	8.9



**Figure A7**  
**Rajah A7**

[4 marks]

[4markah]

CLO1  
C1**QUESTION 8**  
**SOALAN 8**

Moment Distribution Method was introduced by Hardy Cross in the year 1930 to overcome the difficulties that arose when solving problems of statically indeterminate beams using the Slope Deflection Method. List **FOUR (4)** advantages of using Moment Distribution Method

*Kaedah Agihan Momen telah diperkenalkan oleh Hardy Cross pada tahun 1930 bagi mengatasi kesukaran yang timbul apabila menyelesaikan masalah rasuk tak boleh tentu statik dengan menggunakan Kaedah Cerun Pesongan. Senaraikan **EMPAT (4)** kebaikan penggunaan Kaedah Agihan Momen.*

[4 marks]

[4 markah]

CLO1  
C2**QUESTION 9**  
**SOALAN 9**

Determine the end moment from the moment distribution table below (**Table A9**).

*Dapatkan nilai momen akhir daripada jadual momen agihan di bawah (**Jadual A9**)*

[4 marks]

[4 markah]

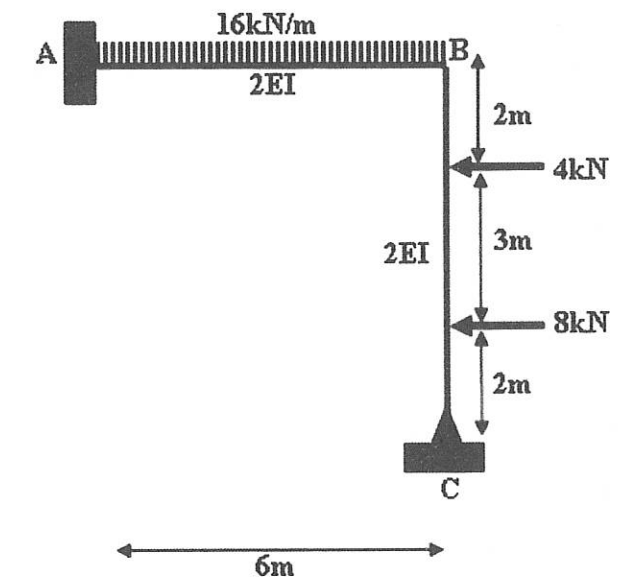
**Table A9****Jadual A9**

Joint	A	B		C
Members	AB	BA	BC	CB
DF	0	5/9	4/9	0
COF	0	0.5	0.5	0
FEM	-54.67	+54.67	-5.76	+8.64

CLO1  
C2**QUESTION 10**  
**SOALAN 10**

Determine the fixed end moment ( $M^F$ ) of the frame shown in **Figure A10**.

*Tentukan Momen Hujung Terikat ( $M^F$ ) bagi kerangka portal yang ditunjukkan di dalam **Rajah A10**.*

**Figure A10****Rajah A10**

[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 struktur. Jawab **TIGA (3)** soalan sahaja.

## QUESTION 1

## SOALAN 1

A continuous beam carries a uniformly distributed load (UDL) of 39N/m over AB and point loads (PL) of 42N as shown in **Figure B1** below. By using **Slope Deflection Method**:-

Satu rasuk selanjur yang dikenakan beban teragih seragam bernilai 39N/m dari rentang AB dan beban tumpu bernilai 42N dari rentang BC seperti yang di tunjukkan oleh **Rajah B1** dibawah. Dengan menggunakan **Kaedah Cerun Pesongan**:-

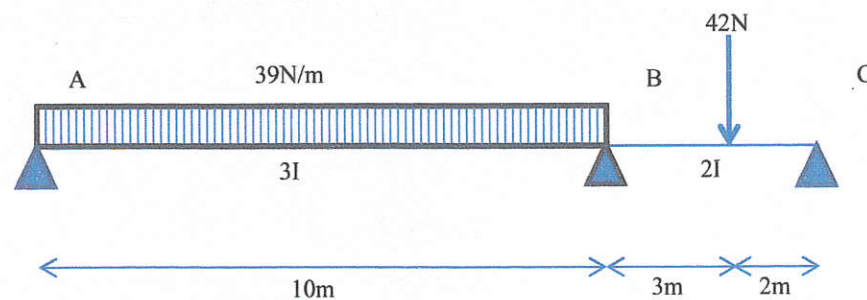


Figure B1

Rajah B1

- |            |  |                           |
|------------|--|---------------------------|
| CLO1<br>C2 | (a) determine Fixed End Moment.<br><i>tentukan nilai momen hujung terikat (MHT)</i>  | [2 Marks]<br>[2 Markah]   |
| CLO1<br>C3 | (b) calculate value $\theta_A$ , $\theta_B$ and $\theta_C$ .<br><i>kirakan nilai <math>\theta_A</math>, <math>\theta_B</math> dan <math>\theta_C</math>.</i> | [14 Marks]<br>[14 Markah] |
| CLO1<br>C2 | (c) determine end moments at support A, B and C.<br><i>tentukan momen akhir pada tumpang A, B dan C.</i>   | [4 Marks]<br>[4 Markah]   |

## QUESTION 2

## SOALAN 2

A portal frame is subjected to load as shown in **Figure B2**. By using the Slope Deflection Method:-

Kerangka portal dikenakan beban seperti ditunjukkan dalam **Rajah B2**. Menggunakan **Kaedah Cerun Pesongan**:-

- |            |  |                         |
|------------|--|-------------------------|
| CLO1<br>C2 | a) determine the Slope Deflection Equation.<br><i>tentukan persamaan cerun pesongan</i>                              | (8 marks)<br>(8 markah) |
| CLO1<br>C3 | b) calculate the value of $\theta$ .<br><i>kirakan nilai <math>\theta</math>.</i>                                    | (4 marks)<br>(4 markah) |
| CLO1<br>C3 | c) calculate the value of internal moment for portal frame.<br><i>kirakan nilai momen dalam bagi kerangka portal</i> | (8 marks)<br>(8 markah) |

Below are the value for the Fixed End Moment for portal frame:

Di bawah adalah nilai-nilai Momen Hujung Terikat bagi kerangka portal:

$$M_{AB}^F = M_{BA}^F = 0, M_{BC}^F = M_{CB}^F = +93.75 \text{ kNm}, M_{CD}^F = -57.6 \text{ kNm}$$

$$M_{CE}^F = M_{EC}^F = 0$$

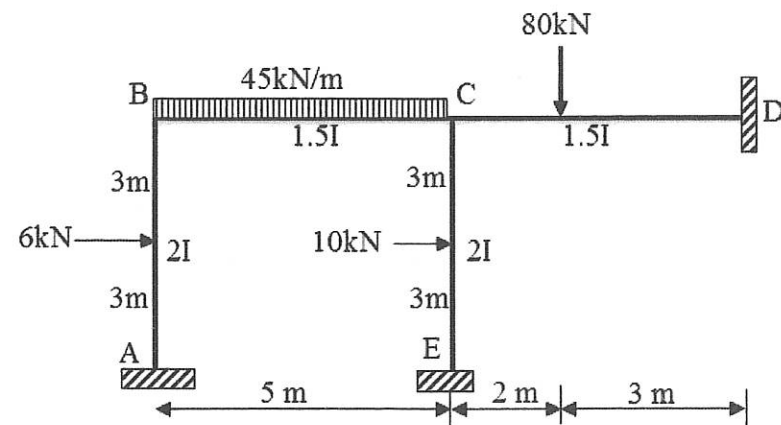


Figure B2  
Rajah B2

## QUESTION 3

## SOALAN 3

Figure B3 shows beam ABC that is subjected with a point load of 8kN and uniformly distributed load (UDL) of 10kN/m. Use **Moment Distribution Method** to calculate:

Rajah B3 menunjukkan rasuk ABC yang dikenakan beban tumpu 8kN dan beban teragih seragam 10kN/m. Guna Kaedah Agihan Momen bagi mengira:

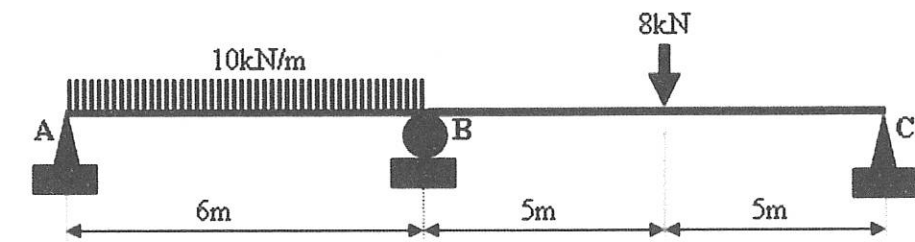


Figure B3  
Rajah B3

- CLO3  
C3 (a) Fixed End Moment ( $M^F$ ) for each span.  
Momen Hujung terikat bagi setiap rentang.
- CLO3  
C3 (b) Stiffness Factor (K) and Distribution Factor (DF).  
Faktor kekukuhan (K) dan Faktor Agihan (DF).
- CLO3  
C3 (c) Final moment value.  
Jumlah momen akhir.
- CLO3  
C3 (d) Reaction at support A, B and C.  
Daya tindakbalas pada penyokong A, B dan C.

[3 marks]  
[3 markah]

[5 marks]  
[5 markah]

[8 marks]  
[8 markah]

[4 marks]  
[4 markah]



**QUESTION 4**  
**SOALAN 4**

A portal frame is subjected to loads as shown in **Figure B4**. By using Moment Distribution Method;

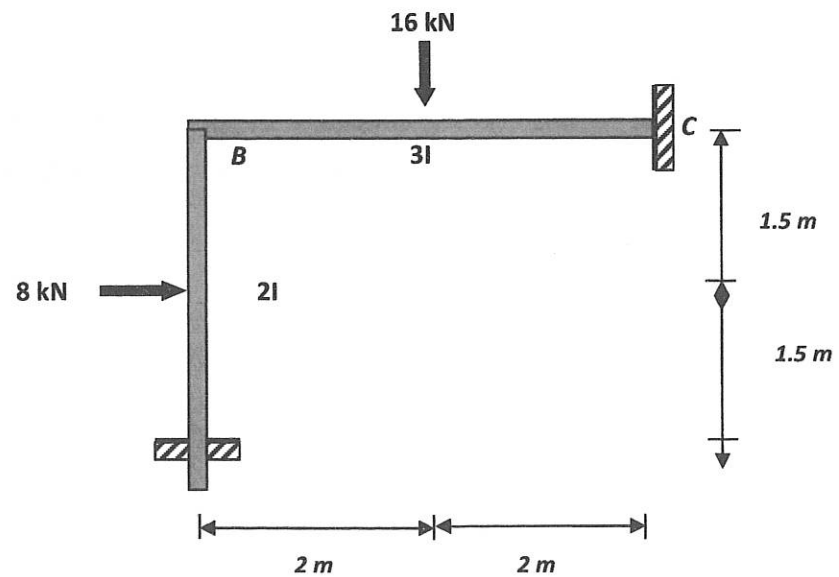
*Kerangka portal dikenakan daya sebagaimana Rajah B4. Dengan menggunakan Kaedah Agihan Momen;*

- CLO1  
C3 a) calculate the end moments  
*kirakan momen akhir*

[10 marks]  
[10 markah]

- CLO1  
C3 b) sketch shear force and bending moment for the portal frame

*lukiskan Gambarajah Daya ricih dan Momen Lentur bagi rasuk tersebut*  
[10 marks]  
[10markah]



**Figure B4**  
**Rajah B4**

**SOALAN TAMAT**

CC505 – STRUCTURAL ANALYSIS 1

FORMULAE

**1. Slope Deflection Method**

$$M_{AB} = [2EI/L][2\theta_A + \theta_B - (3\Delta/L)] + M_{AB}^F$$

$$M_{BA} = [2EI/L][2\theta_B + \theta_A - (3\Delta/L)] + M_{BA}^F$$

**2. Moment Distribution Method**

$$M_{BC}^S = M_{CB}^S = \frac{+6EI\Delta_B}{L_{BC}^2} @ \frac{3EI\Delta}{L^2}$$

**Table 1: Fixed End Moment**

$M_{AB}^F = \frac{-wL^2}{12}$		$M_{BA}^F = \frac{wL^2}{12}$
$M_{AB}^F = \left(\frac{-wab^2}{L^2}\right)$		$M_{BA}^F = \left(\frac{wba^2}{L^2}\right)$
$M_{AB}^F = \frac{-wL}{8}$		$M_{BA}^F = \frac{wL}{8}$