

SULIT



**KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI II : 2024/2025

DCC40163 : THEORY OF STRUCTURES

TARIKH : 19 MEI 2025

MASA : 2.30 PM – 4.30 PM (2 JAM)

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

Bahagian A: Subjektif (2 soalan)

Bahagian B: Subjektif (4 soalan)

Dokumen sokongan yang disertakan : FORMULA

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A: 50 MARKS**BAHAGIAN A: 50 MARKAH****INSTRUCTION:**

This section consists of **TWO (2)** subjective questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi **DUA (2)** soalan subjektif. Jawab **SEMUA** soalan.

QUESTION 1**SOALAN 1**

- CLO2 (a) A statically determinate truss with external horizontal load, 20 kN and vertical external load 50 kN is shown in Figure A1(a). Identify the internal force in each member of the truss by using the Method of Joint.

Kekuda boleh tentu statik yang dikenakan beban luar mendatar sebanyak 20 kN dan beban luar secara pugak, 50 kN ditunjukkan dalam Rajah A1(a). Kenal pasti daya dalaman bagi setiap anggota kekuda menggunakan Kaedah Sendi.

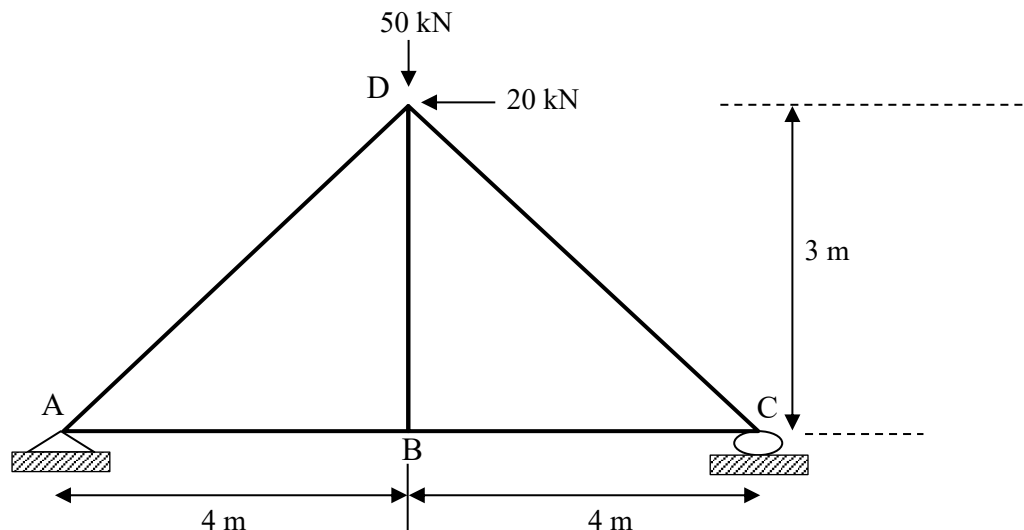


Figure A1(a) / Rajah A1(a)

[8 marks]

[8 markah]

CLO2

- (b) A statically determinate trusses is subjected to a horizontal external load at joint A and D as shown in Figure A1(b)(i). Determine the value of horizontal displacement of joint C, if the internal force in each member of the truss is due to horizontal unit load shown in Figure A1(b)(ii). Given the cross-sectional area of each member is 500 mm^2 and the Elastic Modulus is 200 kN/mm^2 .

Sebuah kekuda boleh tentu statik dikenakan beban luar secara mengufuk di sambungan A dan D seperti di Rajah A1(b)(i). Tentukan nilai anjakan mengufuk bagi sambungan C jika daya dalaman terhadap daya yang disebabkan oleh beban unit secara mengufuk di sambungan C ditunjukkan di dalam Rajah A1(b)(ii). Diberi nilai keluasan bagi setiap anggota adalah 500 mm^2 dan nilai dan Modulus Keanjalan ialah 200 kN/mm^2 .

Real System/Sistem Sebenar

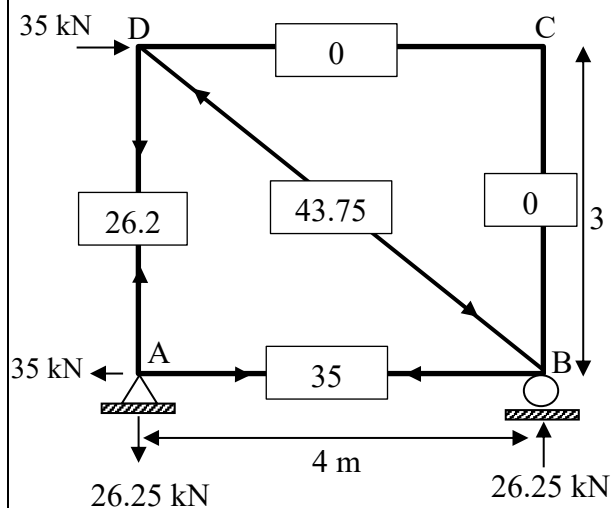


Figure A1(b)(i) / Rajah A1(b)(i)

Virtual System/Sistem Maya

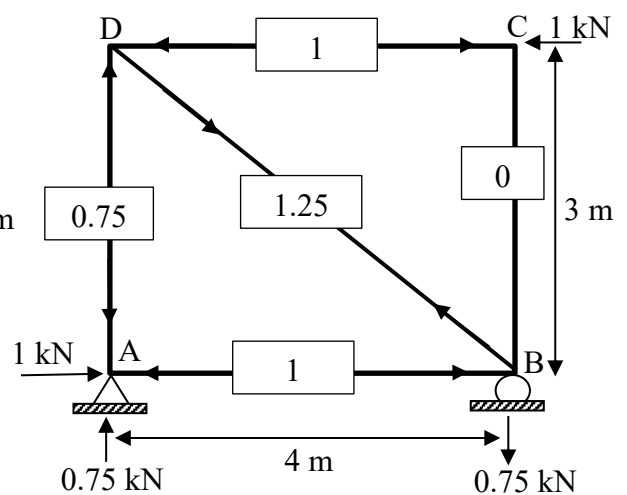


Figure A1(b)(ii) / Rajah A1(b)(ii)

[7 marks]

[7 markah]

CLO2

- (c) A statically indeterminate truss is subjected to an external load as shown in Figure A1(c). Assume the cross-sectional area, A and the modulus of elasticity, E are constant for each member of the truss. Analyze the actual forces in all members of the truss by using magnitude of redundant (R) if AC member is a redundant. Given $A_x = 12\text{ kN}$, $A_y = 17.14\text{ kN}$ and $B_y = 37.86\text{ kN}$.

Sebuah kekuda tidak boleh tentu statik dikenakan beban luaran seperti yang ditunjukkan Rajah A1(c). Anggap luas keratan rentas, A dan modulus keanjalan, E adalah malar bagi setiap anggota kekuda. Analisis daya dalaman bagi semua anggota kekuda dengan menggunakan magnitud kelebihan (R) jika anggota AC adalah kelebihan. Diberi $A_x = 12\text{ kN}$, $A_y = 17.14\text{ kN}$ and $B_y = 37.86\text{ kN}$.

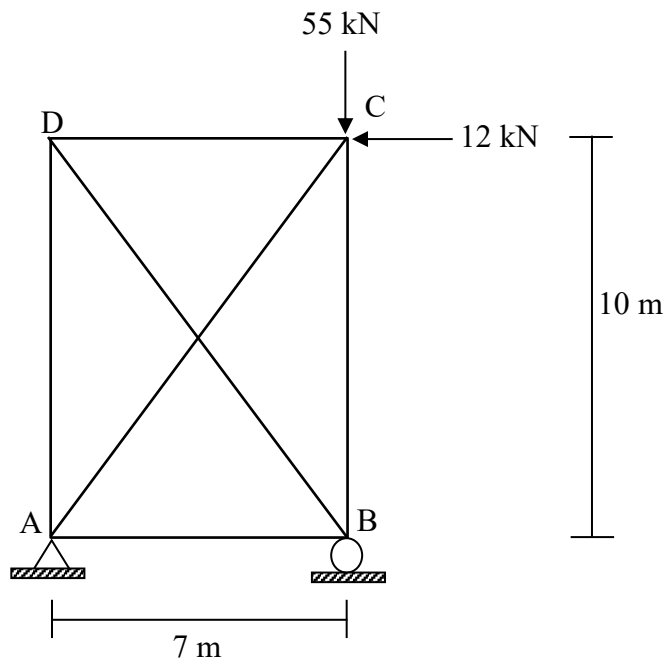


Figure A1(c) / Rajah A1(c)

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

CLO3

- (a) The overhanging beam is subjected to a point load and uniformly distributed load as shown in Figure A2(a). By using Influence Lines Diagram Method, calculate:

Rasuk julur dikenakan beban tumpu dan beban teragih seragam seperti yang ditunjukkan dalam Rajah A2(a). Dengan menggunakan Kaedah Gambarajah Garis Imbas, kirakan:

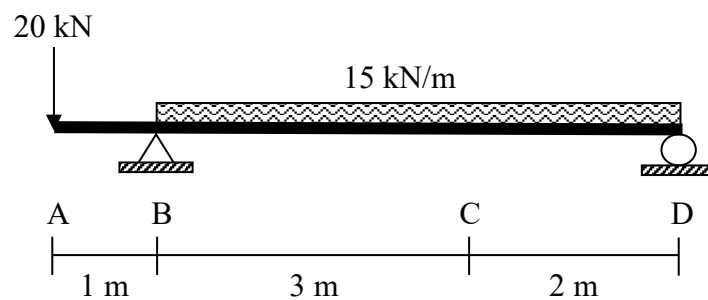


Figure A2(a) / Rajah A2(a)

- i. Shear force at point C.
Daya ricih pada titik C.

[6 marks]

[6 markah]

- ii. Reaction at point B.
Daya tindak balas pada titik B.

[5 marks]

[5 markah]

- CLO3 (b) A 12 m long simply supported beam carried a series of concentrated loads as shown in Figure A2(b) below. Evaluate the absolute maximum moment in the beam produced by the wheel loads by using Influence Line Diagram.

Rasuk tupang mudah sepanjang 12 m dikenakan satu siri beban tertumpu seperti yang ditunjukkan dalam Rajah A2(b) di bawah. Nilai momen maksimum mutlak dalam rasuk yang dihasilkan oleh beban roda dengan menggunakan garis imbas.

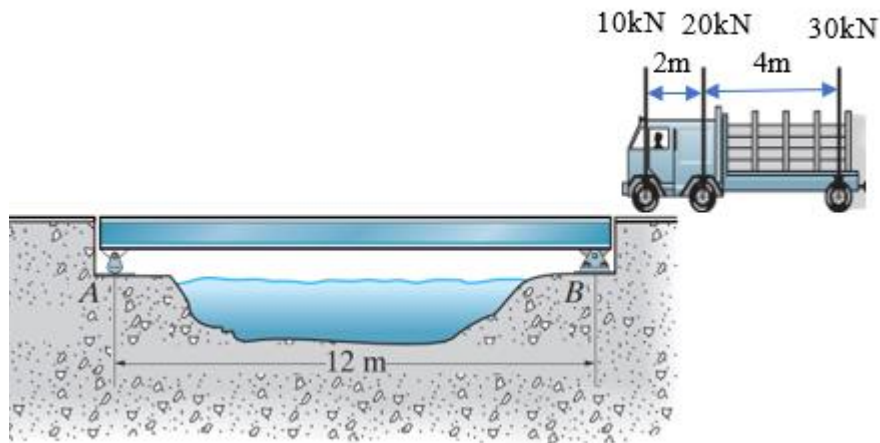


Figure A2(b)/ Rajah A2(b)

[14 marks]

[14 markah]

SECTION B: 50 MARKS**BAHAGIAN B: 50 MARKAH****INSTRUCTION:**

This section consists of **FOUR (4)** subjective questions. Answer **TWO (2)** questions only.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan subjektif. Jawab DUA (2) soalan sahaja.

QUESTION 1**SOALAN 1**

The statically indeterminate beam is fixed in support A, while B and C are supported by a roller and pin as shown in Figure B1. The beam carries a 11 kN point load at point D. The beam also carries a uniformly distributed load of 33 kN/m along AB and 8 kN/m along BC. EI value is constant for all members. According to the slope Deflection Method:

Sebuah rasuk tidak boleh tentu yang diikat tegar pada penyokong A manakala penyokong B dan C masing-masing diikat secara pin dan rola seperti Rajah B1. Rasuk ini dikenakan beban tumpu sebanyak 11 kN pada titik D. Rasuk ini juga dikenakan beban teragih seragam 33 kN/m di sepanjang AB dan 8 kN/m di sepanjang BC. Nilai EI adalah malar di sepanjang rasuk. Berpandukan kaedah cerun pesongan:

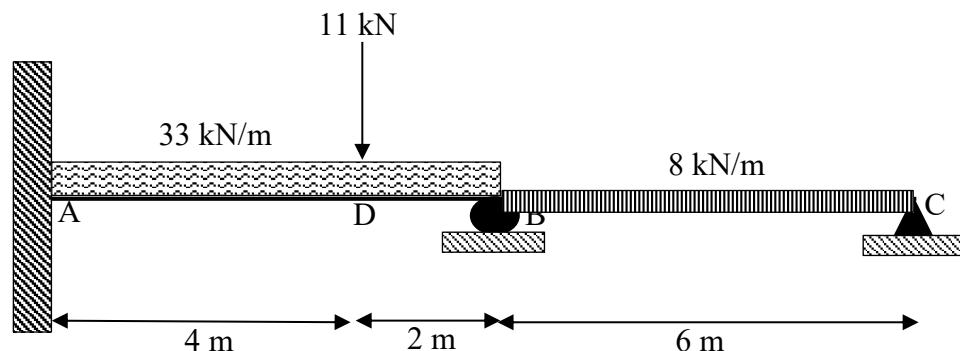


Figure B1 / Rajah B1

- CLO1 (a) Identify the value of fixed end moment for each span in Figure B1.
Kenal pasti nilai momen hujung terikat pada setiap rentang dalam Rajah B1.
 [4 marks]
 [4 markah]
- CLO1 (b) Identify the slope deflection equations for each span in Figure B1.
Kenal pasti persamaan cerun pesongan pada setiap rentang dalam Rajah B1.
 [6 marks]
 [6 markah]
- CLO1 (c) The continuous beam is subjected to a uniformly distributed load of 24 kN/m along span AB with length 5 m and a point load of 40 kN at the middle of span BC with 4 m length. Given the slope deflection equation as follows:
Rasuk selanjar dikenakan beban teragih seragam sebanyak 24 kN/m di sepanjang rentang AB sepanjang 5 m dan beban tumpu 40 kN di tengah-tengah rentang BC sepanjang 4 m. Diberi persamaan cerun pesongan seperti berikut:
- $$M_{AB} = \frac{3EI}{5}(\theta_B) - 50, M_{BA} = \frac{3EI}{5}(2\theta_B) + 50$$
- $$M_{BC} = \frac{2EI}{4}(2\theta_B) - 20, M_{CB} = \frac{2EI}{4}(\theta_B) + 20$$
- i. Calculate the final moment for each span.
Kirakan momen akhir bagi setiap anggota.
 [7 marks]
 [7 markah]
- ii. Sketch the shear force diagram.
Lakarkan gambarajah daya ricih.
 [8 marks]
 [8 markah]

QUESTION 2**SOALAN 2**

The portal frame shown in Figure B2 is a non-swaying portal frame. A frame is fixed at A and C carries a uniformly distributed load and point loads.

Sebuah kerangka portal seperti dalam Rajah B2 merupakan sebuah kerangka portal tanpa huyung. Kerangka tersebut diikat tegar pada A dan C dikenakan beban teragih seragam dan beban tumpu.

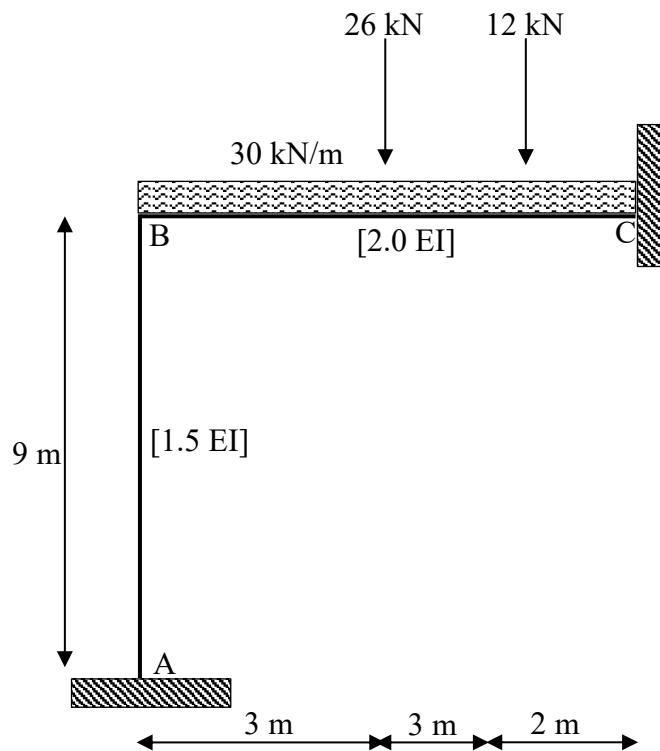


Figure B2 / Rajah B2

- CLO1 (a) Identify the value of Fixed End Moment (FEM) for each member in Figure B2.
Kenal pasti nilai momen hujung terikat bagi setiap anggota di dalam Rajah B2.

[4 marks]

[4 markah]

- CLO1 (b) Indicate the slope deflection equation for each member Moment Equation by using Slope Deflection Method for Figure B2.
Tunjukkan persamaan cerun pesongan bagi setiap anggota dengan menggunakan Kaedah Cerun Pesongan bagi Rajah B2.
- [6 marks]
[6 markah]
- CLO1 (c) Based on the Slope Deflection Method:
Berpandukan kepada Kaedah Cerun Pesongan:
- i. Calculate the final moment at each support in Figure B2.
Kirakan momen akhir pada setiap penyokong di dalam Rajah B2.
- [7 marks]
[7 markah]
- ii. Sketch the shear force diagram for the portal frame.
Lakarkan gambarajah daya ricih bagi kerangka portal tersebut.
- [8 marks]
[8 markah]

QUESTION 3**SOALAN 3**

A continuous beam is pinned at A, roller at B and fixed at C respectively is subjected to a uniformly distributed load and point loads as shown in Figure B3. By using Moment Distribution Method:

Satu rasuk selanjur yang di pin pada A, di roda pada B dan diikat tegar pada C dikenakan dengan beban teragih seragam dan beban titik seperti yang ditunjukkan dalam Rajah B3. Dengan menggunakan Kaedah Agihan Momen:

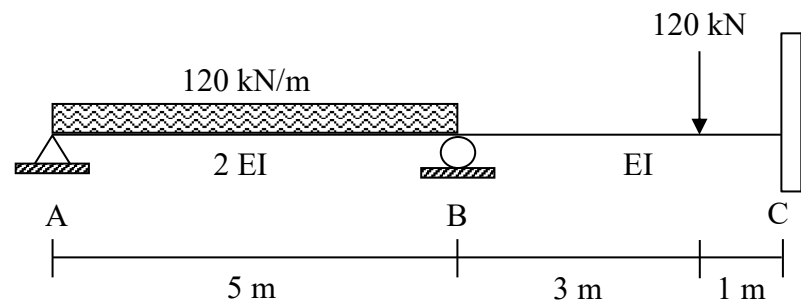


Figure B3 / Rajah B3

- CLO1 (a) Identify value of fixed end moment (FEM) for support A, B and C in Figure B3.
Kenal pasti nilai momen hujung terikat (FEM) bagi penyokong A, B dan C dalam Rajah B3.

[4 marks]

[4 markah]

- CLO1 (b) Identify value of stiffness factors (K) and distribution factor (DF) for the beam as shown in Figure B3.

Kenal pasti nilai faktor kekukuhan (K) dan faktor agihan (DF) pada rasuk seperti yang ditunjukkan dalam Rajah B3.

[6 marks]

[6 markah]

CLO1

- (c) A continuous beam is subjected to a point load and uniformly distributed load as shown in Figure B3(c). The value of fixed end moment (FEM) of beam and distribution factor (DF) at joint B is given as follows:

Satu rasuk selangar dikenakan beban tumpu dan beban teragih seragam seperti yang ditunjukkan dalam Rajah B3(c) Diberi nilai momen hujung terikat (FEM) rasuk dan faktor agihan (DF) diberikan pada titik B adalah seperti berikut:

$$FEM_{AB} = -10 \text{ kNm} \quad , \quad FEM_{BC} = -40 \text{ kNm}$$

$$FEM_{BA} = 10 \text{ kNm} \quad , \quad FEM_{CB} = 40 \text{ kNm}$$

$$DF_{BA} = 0.57 \quad , \quad DF_{BC} = 0.43$$

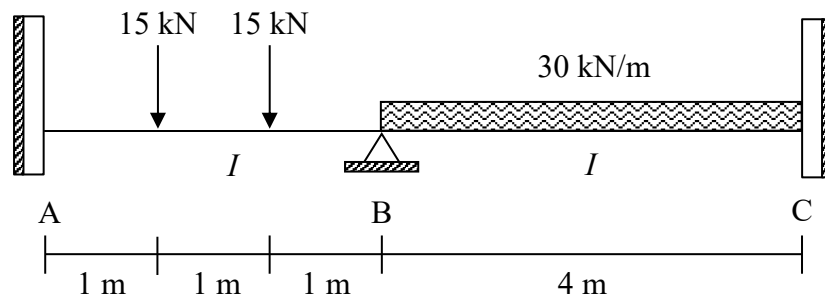


Figure B3(c) / Rajah B3(c)

- i. Calculate the final moment for each span of the beam in Figure B3(c) by using the Moment Distribution Method.

Kirakan momen akhir bagi setiap rentang rasuk dalam Rajah B3(c) dengan menggunakan Kaedah Agihan Momen.

[7 marks]

[7 markah]

- ii. Sketch the Shear Force Diagram for the beam.

Lakarkan Gambarajah Daya Ricih bagi rasuk tersebut.

[8 marks]

[8 markah]

QUESTION 4**SOALAN 4**

A non-sway frame is subjected to uniformly distributed load and point load as shown in Figure B4. The value of EI is constant for each span and value of stiffness factor (K) at joint B is given as follows:

Satu kerangka tidak huyung dikenakan beban teragih seragam dan beban titik seperti ditunjukkan dalam Rajah B4. Nilai EI adalah malar bagi setiap rentang dan nilai faktor kekukuhan (K) diberikan pada titik B seperti berikut:

$$K_{BA} = 0.5 EI \quad , \quad K_{BC} = 0.8 EI$$

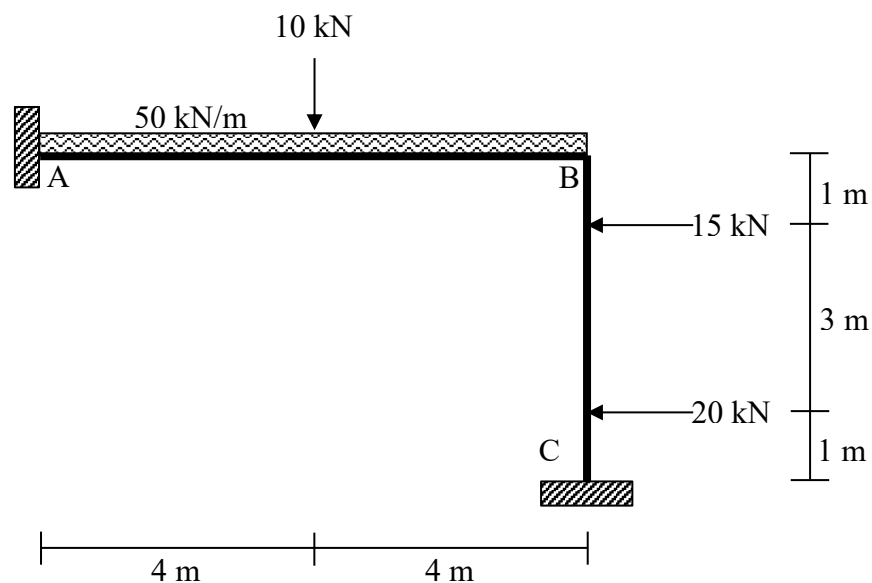


Figure B4 / Rajah B4

CLO1

- (a) Identify the distribution factor (DF) of point A, B and C in Figure B4.

Kenal pasti faktor agihan (DF) pada titik A, B dan C dalam Rajah 4.

[4 marks]

[4 markah]

CLO1

- (b) Identify the fixed end moment (FEM) for each span.

Kenal pasti nilai momen hujung terikat (FEM) pada setiap rentang.

[6 marks]

[6 markah]

CLO1

- (c) A non-sway portal frame carries a uniformly distributed load and point load along member BC as shown in Figure B4(c). Given the value of fixed end moment (FEM) of portal frame as follows:

Satu kerangka portal tidak huyung yang dikenakan dengan beban teragih seragam dan beban titik di sepanjang anggota BC seperti Rajah B4(c). Diberi nilai momen hujung terikat (FEM) kerangka adalah seperti berikut:

$$\text{FEM BA} = \text{FEM AB} = 0, \text{FEM BC} = -14.17 \text{ kNm}, \text{FEM CB} = 14.17 \text{ kNm}$$

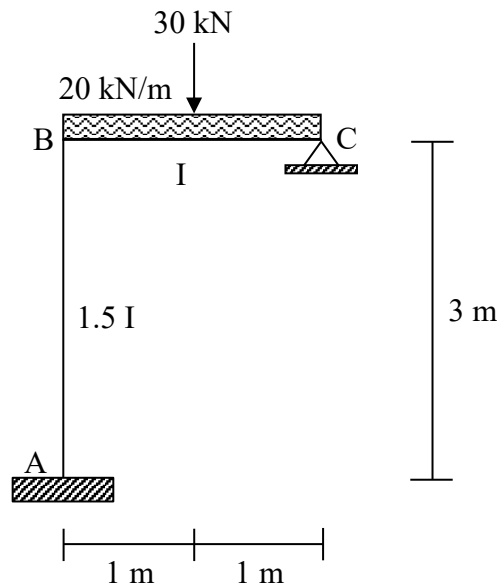


Figure B4(c) / Rajah B4(c)

- i. Calculate the value of stiffness factors (K) and distribution factor (DF) for the portal frame.

Kirakan nilai faktor kekukuhan (K) dan faktor agihan (DF) pada kerangka portal.

[7 marks]

[7 markah]

- ii. Calculate the final moment for each span by using the Moment Distribution Method with **THREE (3)** times of distributions.

*Kirakan momen akhir bagi setiap rentang dengan menggunakan Kaedah Agihan Momen dengan **TIGA (3)** kali agihan.*

[8 marks]

[8 markah]

SOALAN TAMAT

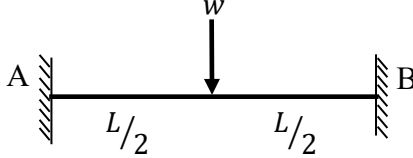
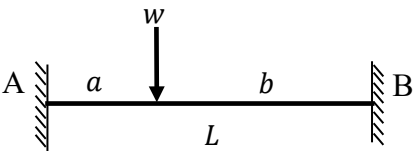
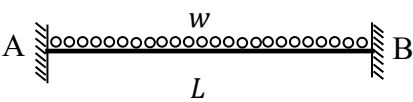
DCC40163 – THEORY OF STRUCTURE
FORMULAE

1. Slope Deflection Method

$$M_{AB} = \frac{2EI}{L_{AB}} \left(2\theta_A + \theta_B - \frac{3\Delta}{L_{AB}} \right) + FEM_{AB}$$

$$M_{BA} = \frac{2EI}{L_{BA}} \left(2\theta_B + \theta_A - \frac{3\Delta}{L_{BA}} \right) + FEM_{BA}$$

Table 1 : Fixed End Moment

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

2. Moment Distribution Method

i. Stiffness Factor

$$K = \frac{4EI}{L} \text{ (for Fixed or Continuous)}$$

$$K = \frac{3EI}{L} \text{ (for Pinned or Roller)}$$

ii. Distribution Factor

$$DF = \frac{K}{\sum K}$$

$$DF = 0 \text{ (for Fixed)}$$

$$DF = 1 \text{ (for Pinned or Roller)}$$

3. Statically Indeterminate Truss

- i. Redundant Force

$$R = -\frac{\sum \left[\frac{P\mu L}{AE} \right]}{\sum \left[\frac{\mu^2 L}{AE} \right]}$$

- ii. Internal Force

$$F_i = P_i + \mu_i R$$

4. Displacement

- i. Displacement caused due to external load

$$\delta = \sum \left[\frac{P\mu L}{AE} \right]$$

5. Influence Lines

- i. Reaction

$$R_A = 1 - \frac{x}{L}, \quad R_B = \frac{x}{L}$$

- ii. Shear Force

$$V_C = -\frac{x}{L}, \quad V_C = 1 - \frac{x}{L}$$

- iii. Moment

$$M_C = \frac{bx}{L}, \quad M_C = a \left(1 - \frac{x}{L} \right)$$