

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 : 2022/2023

DCC40163: THEORY OF STRUCTURES

TARIKH : 06 JUN 2023

MASA : 2.30 PTG – 4.30 PTG (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 is subjected to external loads as shown in Figure A1(a). Identify the internal force in each member of the truss by using Method of Joints.

Sebuah kekuda boleh tentu statik dikenakan beban-beban luaran seperti yang ditunjukkan pada Rajah A1(a). Kenalpasti daya dalaman bagi setiap anggota kekuda menggunakan Kaedah Sendi.

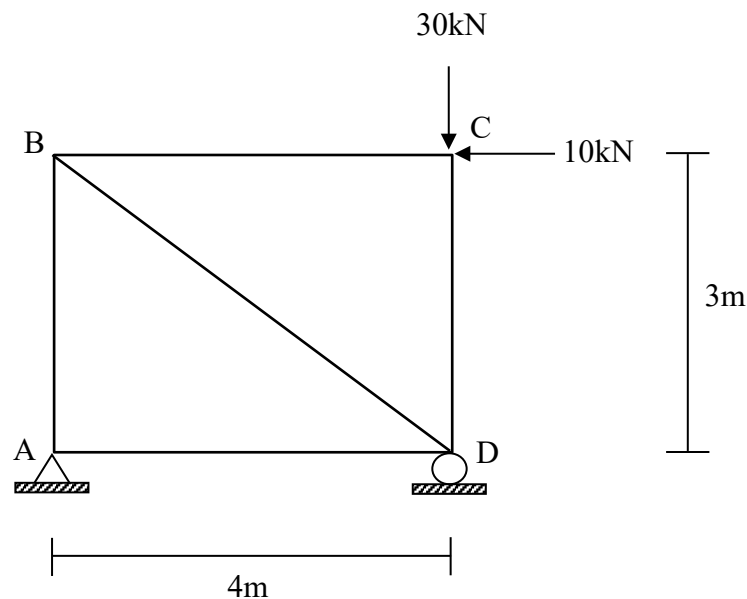


Figure A1(a) / Rajah A1(a)

[8 marks]

[8 markah]

CLO2

- (b) A statically determinate truss is subjected to an external load as shown in Figure A1(b). Determine the internal forces for all members of the truss which is caused by horizontal displacement of joint D due to virtual unit load. Given the cross-sectional area, $A = 0.0015\text{m}^2$, the modulus of elasticity, $E = 200\text{GPa}$ and the value of reactions for real system and virtual system at joint A and B are shown as in Figure A1(b).

Sebuah kekuda boleh tentu statik dikenakan beban luaran seperti yang ditunjukkan Rajah A1(b). Tentukan daya dalaman bagi semua anggota kekuda yang disebabkan oleh anjakan mendatar pada sendi D disebabkan oleh beban unit yang dikenakan. Diberi luas keratan rentas, $A = 0.0015\text{m}^2$ dan modulus keanjalan, $E = 200\text{GPa}$ dan nilai daya-daya tindakbalas untuk sistem sebenar dan sistem maya di sendi A dan B adalah seperti yang ditunjukkan Rajah A1(b).

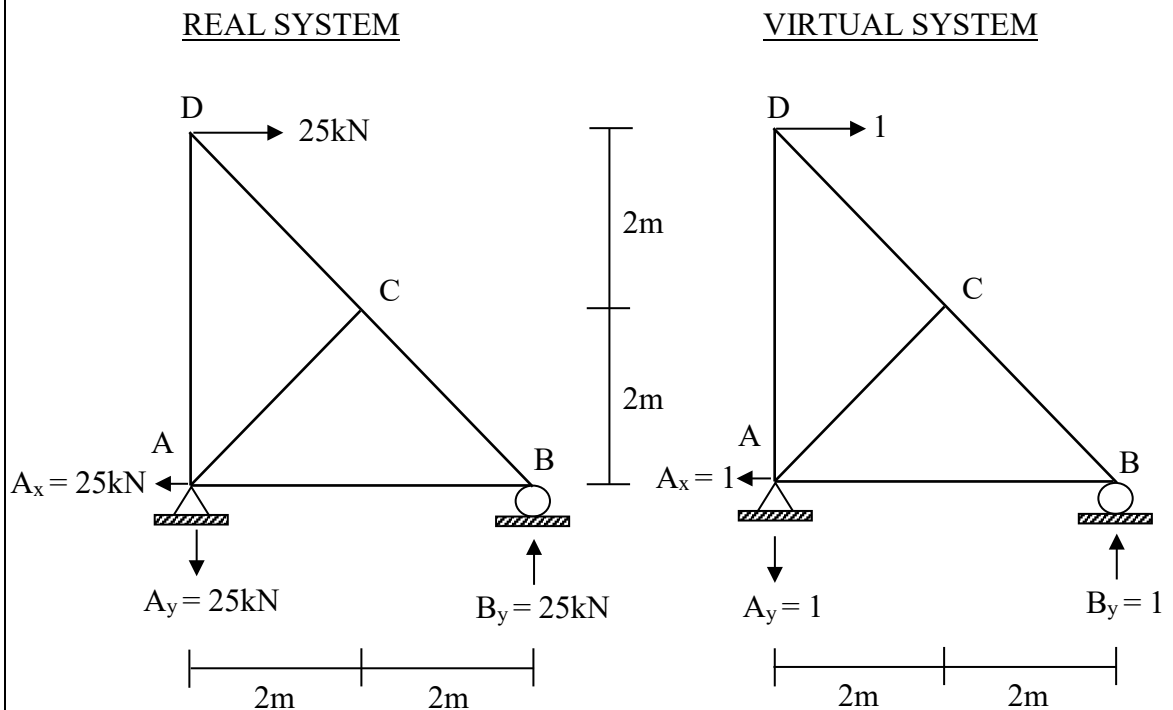


Figure A1(b) / Rajah A1(b)

[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. Calculate the actual forces in all members of the truss by using magnitude of redundant (R) if DB member is a redundant. Given the value of reactions at joint A and D are as in Figure A1(c).

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. Kirakan daya dalaman bagi semua anggota kekuda dengan menggunakan magnitud lebih (R) jika anggota DB adalah lebih. Diberi nilai daya-daya tindakbalas di sendi A dan D adalah seperti yang ditunjukkan Rajah A1(c).

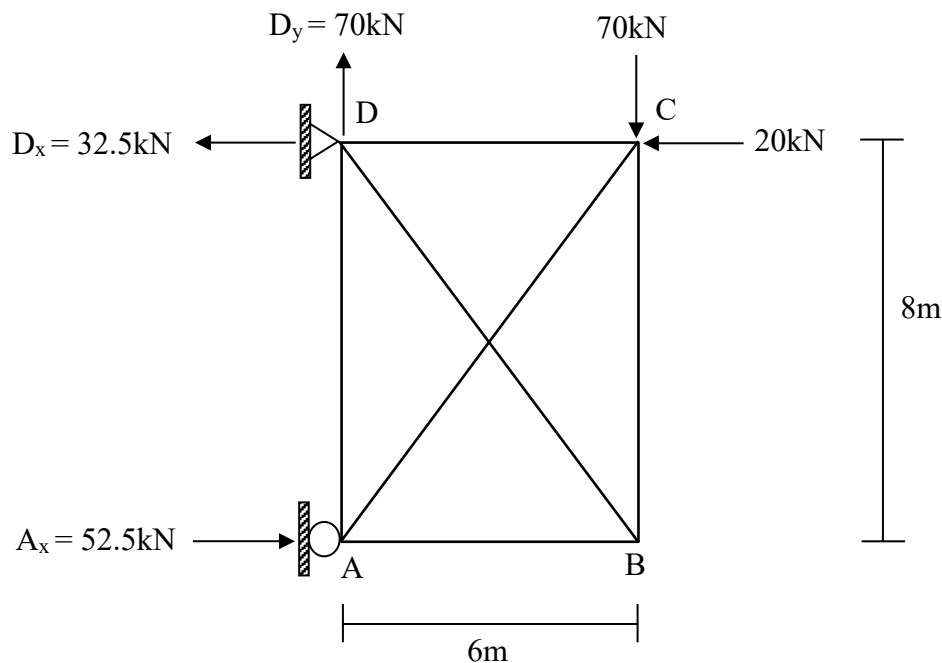


Figure A1(c) / Rajah A1(c)

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

CLO3

- (a) One end overhanging beam is subjected with series of loads as shown in Figure A2(a). By using Influence Lines Diagram Method;

Rasuk julur dikenakan beban siri seperti yang ditunjukkan dalam Rajah A2(a). Dengan menggunakan Kaedah Gambarajah Garis Imbas;

- i. Illustrate the Influence Lines Diagram for shear force and moment at point C.

Lakarkan Gambarajah Garis Imbas daya ricih dan momen pada titik C.

[6 marks]

[6 markah]

- ii. Calculate the maximum shear at point C due to series loads moving from right to left.

Kirakan daya ricih maksimum pada titik C yang disebabkan pergerakan beban siri dari arah kanan ke kiri.

[5 marks]

[5 markah]

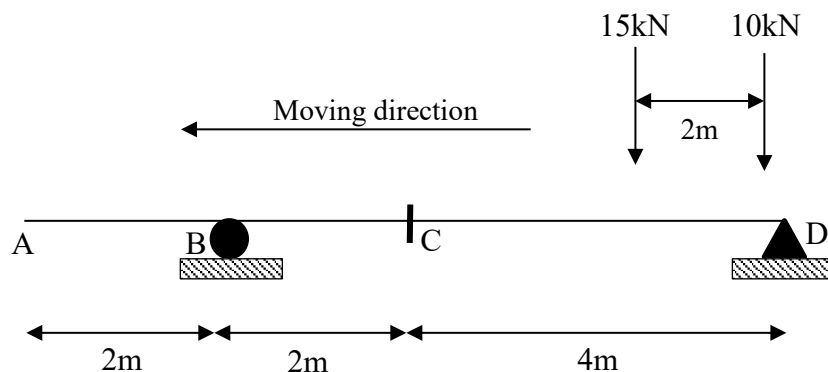


Figure A2(a) / Rajah A2(a)

CLO3

- (b) A beam in Figure A2(b) is subjected to a series of moving loads 12kN, 35kN, 18kN and 50kN respectively. The beam is a simply supported beam that is supported at point A and B. By using Influence Lines Diagram Method, evaluate the Absolute Maximum Moment due to a series loads.

Sebuah rasuk seperti Rajah A2(b) dikenakan satu siri beban yang terdiri daripada 12kN, 35kN, 18kN and 50kN bergerak di atas rasuk. Rasuk ini adalah rasuk disokong mudah yang disokong pada titik A dan titik B. Dengan menggunakan kaedah Gambarajah Garis Imbas, nilaikan Momen Maksimum Mutlak yang disebabkan oleh pergerakan satu siri beban tersebut.

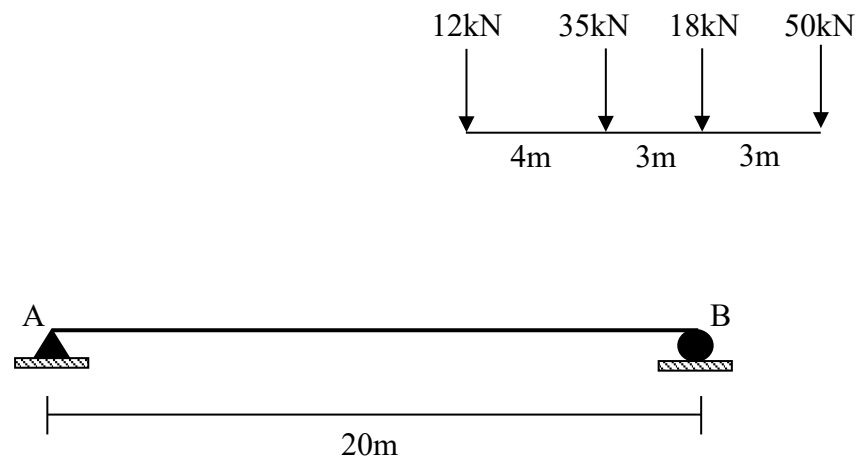


Figure A2(b) / Rajah A2(b)

[14 marks]

[14 markah]

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

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

ARAHAN:

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

QUESTION 1**SOALAN 1**

Figure B1 shows a statically indeterminate beam with two spans which are supported at A, B & C. It carries a uniformly distributed loads of 22kN/m along span AB and point loads 40kN and 7kN at point D and E.

Rajah B1 menunjukkan rasuk tidak boleh tentu statik dengan dua rentang yang disokong pada titik A, B dan C. Rasuk dikenakan beban teragih seragam 22kN/m di sepanjang rentang AB dan beban tumpu 40kN dan 7kN pada titik D dan E.

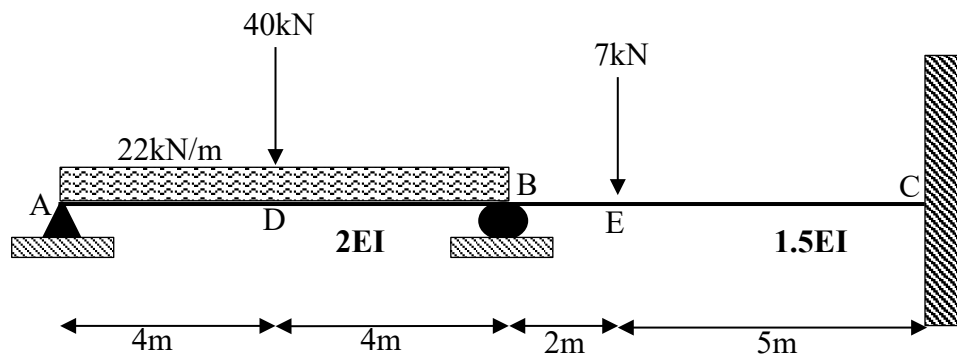


Figure B1 / *Rajah B1*

By using Slope Deflection Method,
Dengan menggunakan Kaedah Cerun Pesongan,

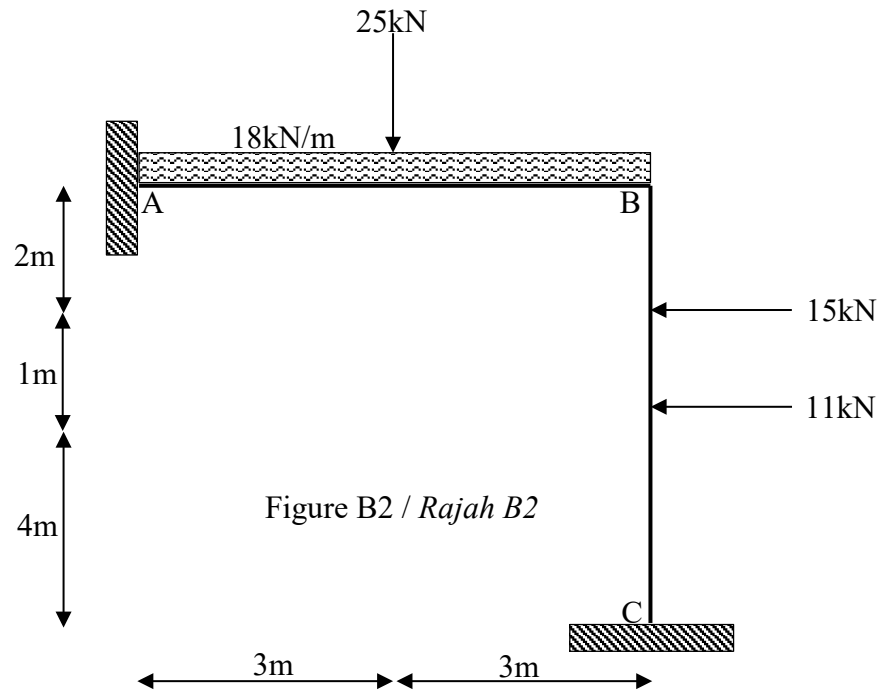
- | | | | |
|------|-----|---|-------------------------|
| CLO1 | (a) | Identify the value of Fixed End Moment for each span.
<i>Kenal pasti nilai momen hujung terikat pada setiap rentang.</i> | [4 marks]
[4 markah] |
| CLO1 | (b) | Show the slope deflection equations for each span.
<i>Tunjukkan persamaan cerun pesongan pada setiap rentang.</i> | [6 marks]
[6 markah] |
| CLO1 | (c) | i. Calculate the final moment for each span.
<i>Kirakan momen akhir bagi setiap rentang.</i> | [7 marks]
[7 markah] |
| | | ii. Sketch the shear force diagram.
<i>Lukiskan gambarajah daya ricih.</i> | [8 marks]
[8 markah] |

QUESTION 2

SOALAN 2

Figure B2 shows a non-swaying portal frame. EI is constant for each member.

Rajah B2 menunjukkan sebuah kerangka portal tanpa huyung. Nilai EI adalah malar untuk setiap rentang.



CLO1

- (a) Identify the value of Fixed End Moment for each member.
Kenal pasti Momen Hujung Terikat pada setiap anggota.

[4 marks]

[4 markah]

- CLO1 (b) Identify the moment equation for each member by using Slope Deflection Method.
Kenal pasti persamaan Momen bagi setiap anggota dengan menggunakan Kaedah Cerun Pesongan.
- [6 marks]
[6 markah]
- CLO1 (c) i. Calculate the final moment by using Slope Deflection Method.
Kirakan momen akhir dengan menggunakan Kaedah Cerun Pesongan.
- [7 marks]
[7 markah]
- ii. Sketch the shear force diagram for the frame.
Lakarkan gambarajah daya ricih bagi kerangka tersebut.
- [8 marks]
[8 markah]

QUESTION 3**SOALAN 3**

Figure B3 shows a continuous beam exerted with 50kN/m uniformly distributed load and point load of 20kN, 25kN and 30kN.

Rajah B3 menunjukkan satu rasuk selanjur dikenakan dengan beban teragih seragam sebanyak 50kN/m dan beban titik sebanyak 20kN, 25kN dan 30kN.

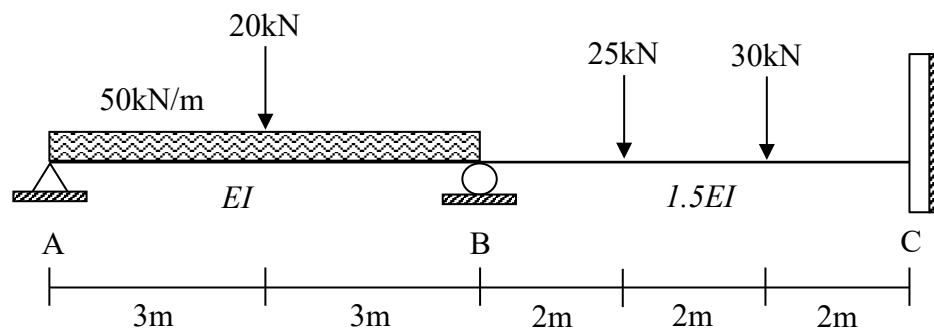


Figure B3 / Rajah B3

Based on Figure B3,

Berdasarkan Rajah B3,

- CLO1 (a) Identify the fixed end moment for each span.
Kenal pasti nilai momen hujung terikat pada setiap rentang.

[4 marks]

[4 markah]

- CLO1 (b) Identify the stiffness and distribution factor for each span.
Kenal pasti faktor agihan dan faktor kekukuhan pada setiap rentang.

[6 marks]

[6 markah]

CLO1

- (c) By using the value of stiffness and distribution factor ;
Dengan menggunakan nilai faktor agihan dan faktor kekakuan ;
- i. 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.*
- [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. Given the value of EI is constant for each span.

Satu kerangka tidak huyung dikenakan beban teragih seragam dan beban titik seperti ditunjukkan dalam Rajah B4. Diberi nilai EI adalah malar bagi setiap rentang.

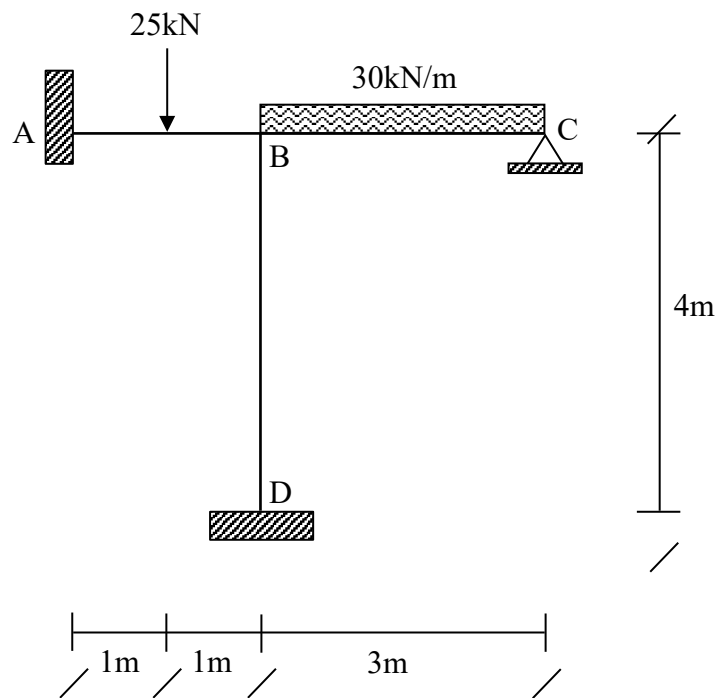


Figure B4 / Rajah B4

Based on Figure B4;

Berdasarkan Rajah B4;

- CLO1 (a) Identify the fixed end moment for each span.
Kenal pasti nilai momen hujung terikat pada setiap rentang.

[4 marks]

[4 markah]

- CLO1 (b) Identify the stiffness and distribution factor for each span.
Kenal pasti faktor agihan dan faktor kekukuhan pada setiap rentang.
- [6 marks]
[6 markah]
- CLO1 (c) By using the value of stiffness and distribution factor;
Dengan menggunakan nilai faktor agihan dan faktor kekukuhan ;
- i. Calculate the final moment for each span by using the Moment Distribution Method with **TWO (2)** times of distributions.
*Kirakan momen akhir bagi setiap rentang dengan menggunakan Kaedah Agihan Momen dengan **DUA (2)** kali agihan.*
- [7 marks]
[7 markah]
- ii. Sketch the Shear Force Diagram for the frame.
Lakarkan Gambarajah Daya Ricih bagi kerangka tersebut.
- [8 marks]
[8 markah]

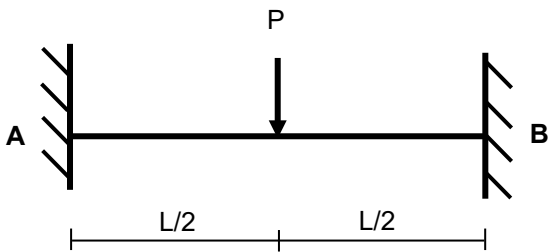
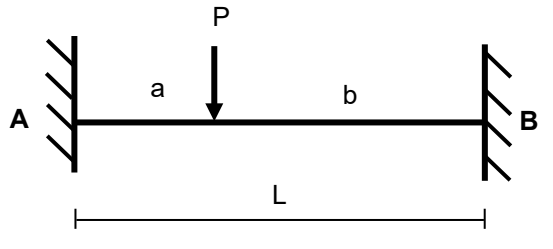
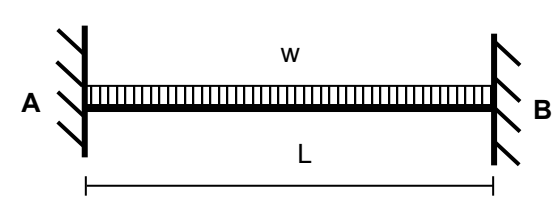
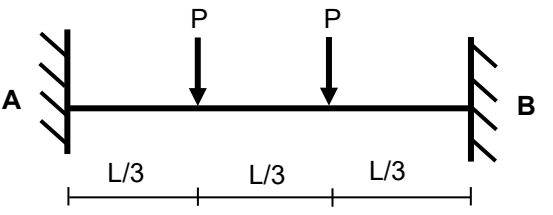
SOALAN TAMAT

DCC40163 – THEORY OF STRUCTURES FORMULAE

1. Slope Deflection Method

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

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

$FEM_{AB} = -\frac{PL}{8}$		$FEM_{BA} = +\frac{PL}{8}$
$FEM_{AB} = -\frac{Pab^2}{L^2}$		$FEM_{BA} = +\frac{Pa^2b}{L^2}$
$FEM_{AB} = -\frac{wL^2}{12}$		$FEM_{BA} = +\frac{wL^2}{12}$
$FEM_{AB} = -\frac{2PL}{9}$		$FEM_{BA} = +\frac{2PL}{9}$

2. Moment Distribution Method

i. Stiffness Factor

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

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

ii. Distribution Factor

$$DF = K / \sum K$$

3. Statically Indeterminate Truss

- i. Redundant Force

$$R = - \frac{\sum P\mu L}{\sum \mu^2 L / AE}$$

- ii. Internal Force

$$F = P + \mu R$$

4. Displacement

- i. external load

$$\Delta = \sum P\mu L / AE$$

- ii. temperature changers

$$\Delta = \sum \mu c L t$$

- iii. fabrication error

$$\Delta = \sum \mu \lambda$$

5. Influence Lines

- i. $R_A = 1 - x/L$, $R_B = x/L$
- ii. $V_C = -x/L$, $R_A = 1 - x/L$
- iii. $M_C = bx/L$, $V_C = a(1 - x/L)$