



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 I : 2024/2025

DCC 40163: THEORY OF STRUCTURE

TARIKH : 26 NOVEMBER 2024

MASA : 11.30 PAGI – 1.30 PETANG (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)

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

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

ARAHAN:

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

QUESTION 1**SOALAN 1**

A statically determinate truss is subjected to an external load as shown in Figure A1. If cross sectional area, $A = 450 \text{ mm}^2$, and modulus of elasticity, $E = 210 \text{ kN/mm}^2$;

Sebuah kekuda boleh tentu statik dikenakan beban luaran seperti yang ditunjukkan dalam Rajah A1(b). Sekiranya luas keratan $A = 450 \text{ mm}^2$, modulus keanjalan, $E = 210 \text{ kN/mm}^2$;

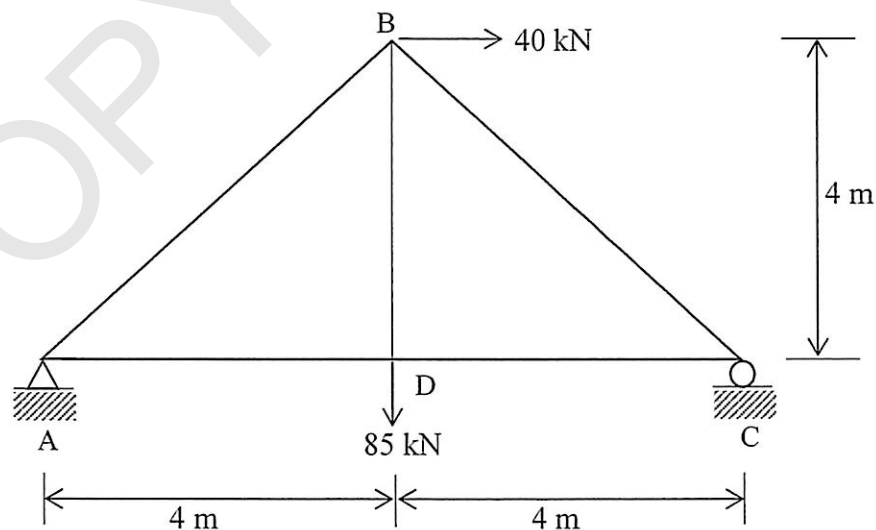


Figure A1 / Rajah A1

- CLO2 (a) Identify the reaction value at each support of the truss.
Kenal pasti nilai tindak balas pada setiap penyokong bagi kekuda tersebut.
 [8 marks]
 [8 markah]

- CLO2 (b) Determine the vertical displacement of joint D if the internal force in each member of the truss due to the vertical unit load at joint D (refer Table A1(b))
Tentukan anjakan menegak bagi sambungan D jika daya dalaman bagi setiap anggota kekuda adalah disebabkan oleh beban unit secara menegak pada sambungan D (rujuk Jadual A1(b)).

Table A1(b) / Jadual A1(b)

Member <i>Anggota</i>	Internal Force due to unit load , μ_i (kN) <i>Daya dalaman disebabkan oleh Beban Unit, μ_i (kN)</i>
AB	-0.707
AD	+0.5
BC	-0.707
BD	+1.0
CD	+0.5

[7 marks]

[7 markah]

- CLO2 (c) A statically indeterminate truss is subjected to an external load as shown in Figure A1(c). Given the cross-sectional area, A and modulus of elasticity, E is constant for each member of the truss and internal force as shown in Table A1(c). Calculate the internal forces for each truss member by using the magnitude of redundant, R . Take member BF as a redundant member.

Sebuah kekuda tidak boleh tentu statik dikenakan beban luaran seperti yang ditunjukkan dalam Rajah A1(c). Diberi luas keratan, A dan modulus keanjalan, E adalah malar pada setiap anggota kekuda dan daya dalaman seperti yang ditunjukkan dalam Jadual A1(c). Kirakan daya dalaman bagi setiap anggota kekuda tersebut dengan menggunakan magnitud lebih (R). Anggota BF dianggap sebagai anggota lebih.

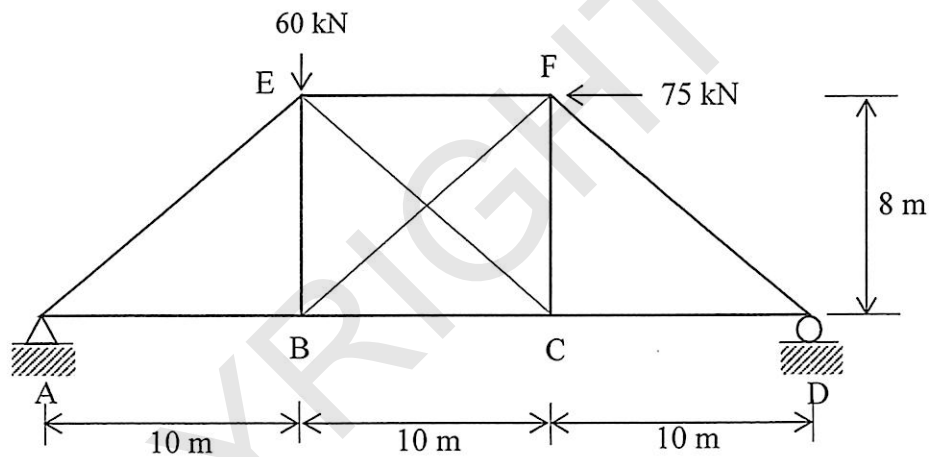


Figure A1(c) / Rajah A1(c)

Table A1(c) / Jadual A1(c)

Member Anggota	Internal Force due to external load ,P (kN) Daya dalaman disebabkan oleh Beban Luar, P (kN)
AB, BC, BE, CE, CF, CD, DF	0
AE	-96
EF	-75

[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 the Influence Line 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:

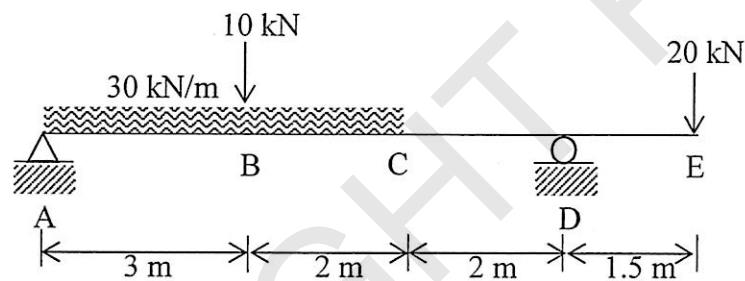


Figure A2(a) / Rajah A2(a)

- (i) Shear Force at Point C.
Daya Ricih di titik C.
- (ii) Bending Moment at Point C.
Momen Lentur di titik C.

[6 marks]

[6 markah]

[5 marks]

[5 markah]

- CLO3 (b) A simply supported beam in Figure A2(b) which supported at A and B is subjected to a series of moving loads of 8 kN, 6 kN and 3 kN respectively. By using the Influence Line Diagram Method, evaluate the Absolute Maximum Moment due to a series of loads moving from right to left.

Sebuah rasuk disokong mudah dalam Rajah A2(b) yang disokong di A dan B dikenakan satu siri beban bergerak masing-masing pada 8 kN, 6 kN dan 3 kN. Dengan menggunakan kaedah Gambarajah Garis Imbas, nilaikan Momen Maksimum Mutlak yang disebabkan oleh pergerakan satu siri dalam satu arah kanan ke kiri.

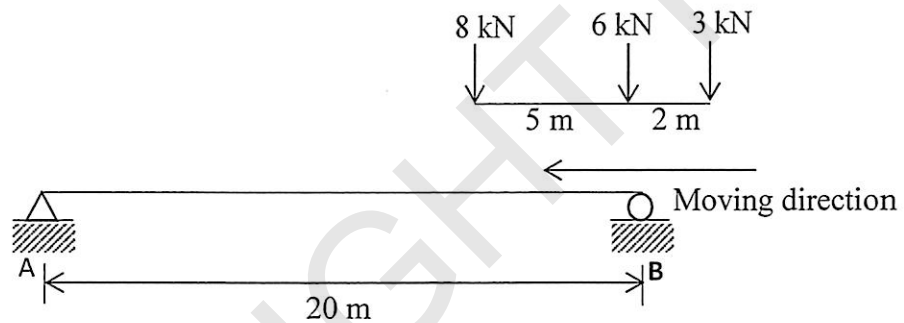


Figure A2(b) / Rajah A2(b)

[14 marks]

[14 markah]

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

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

ARAHAN:

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

QUESTION 1**SOALAN 1**

A continuous beam is fixed in support C, while at A and B each is supported by a pin and a roller as shown in Figure B1. The beam carries a uniformly distributed load of 8 kN/m along AB and 15 kN/m at span BC. EI value is constant for all members. According to the Slope Deflection Method:

Sebuah rasuk selangar yang diikat tegar pada sokong C manakala pada sokong A dan B masing-masing ditupang secara pin dan rola seperti dalam Rajah B1. Rasuk dikenakan beban teragih seragam 8 kN/m di sepanjang rentang AB dan 15 kN/m pada rentang BC. Nilai EI adalah malar untuk setiap rentang. Berpandukan Kaedah Cerun Pesongan:

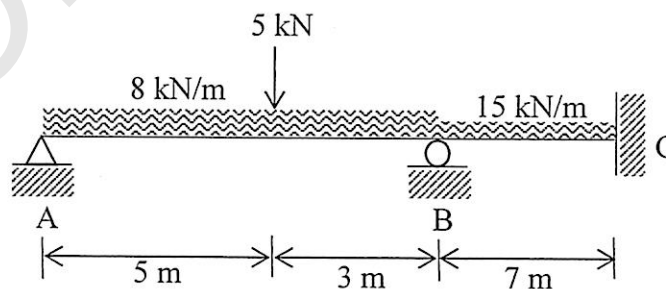


Figure B1 / Rajah B1

- | | |
|------|--|
| CLO1 | <p>(a) Identify the value of the fixed end moment for each span.
 <i>Kenal pasti nilai momen hujung terikat pada setiap rentang.</i></p> <p style="text-align: right;">[4 marks]
[4 markah]</p> |
| CLO1 | <p>(b) Identify the slope deflection equations for each span.
 <i>Kenal pasti persamaan cerun pesongan bagi setiap rentang.</i></p> <p style="text-align: right;">[6 marks]
[6 markah]</p> |
| CLO1 | <p>(c) Based on the slope deflection equation from Q1(b),
 <i>Berdasarkan persamaan cerun pesongan dari Q1(b),</i></p> <p style="margin-left: 40px;">(i) Calculate the final moment for each span by using Slope Deflection Method.
 <i>Kirakan momen akhir bagi setiap anggota dengan menggunakan Kaedah Cerun Pesongan.</i></p> <p style="text-align: right; margin-left: 300px;">[7 marks]
[7 markah]</p> <p style="margin-left: 40px;">(ii) Illustrate the shear force diagram.
 <i>Lukiskan gambarajah daya ricih.</i></p> <p style="text-align: right; margin-left: 300px;">[8 marks]
[8 markah]</p> |

QUESTION 2**SOALAN 2**

Figure B2 shows a portal frame that is subjected to a uniformly distributed load. EI is constant for each member.

Rajah B2 menunjukkan sebuah kerangka yang dikenakan beban teragih seragam. Nilai EI adalah malar bagi setiap anggota.

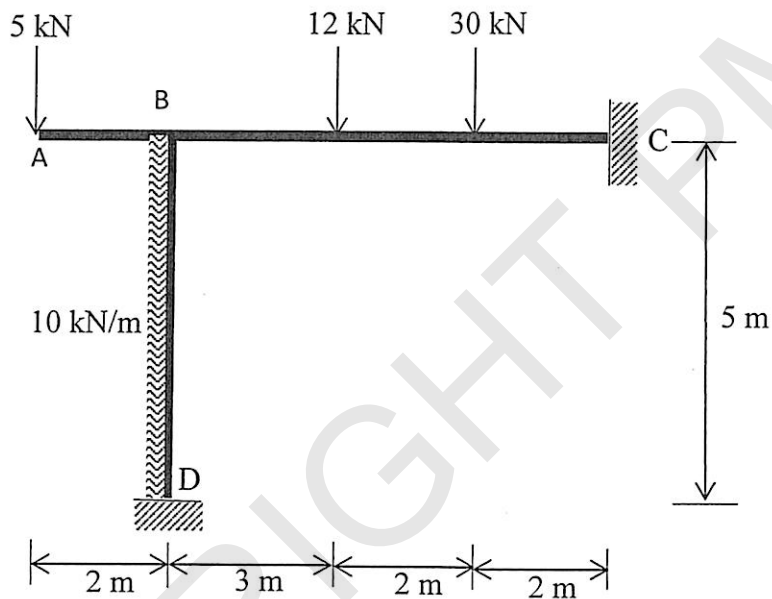


Figure B2 / Rajah B2

- CLO1 (a) Identify the value of the Fixed End Moment (M^F) for each span.
Tentukan nilai Momen Hujung Terikat (MHT) bagi setiap rentang.
 [4 marks]
 [4 markah]
- CLO1 (b) Identify the moment equation for each support by using the Slope Deflection Methods.
Tentukan persamaan momen pada setiap penyokong dengan menggunakan Kaedah Cerun Pesongan.
 [6 marks]
 [6 markah]

- CLO1 (c) A non-sway portal frame with different EI is shown in Figure B2(c). Given the slope deflection equation as follows:

Sebuah kerangka portal tanpa huyung dengan nilai EI yang berbeza ditunjukkan pada Rajah B2(c). Diberi persamaan cerun pesongan adalah seperti berikut:

$$M_{AB} = \frac{2EI\theta_B}{5} - 6.25, M_{BA} = \frac{4EI\theta_B}{5} + 6.25,$$

$$M_{BC} = \frac{12EI\theta_B}{7} + \frac{6EI\theta_C}{7} - 40.83, M_{CB} = \frac{6EI\theta_B}{7} + \frac{12EI\theta_C}{7} + 40.83,$$

$$M_{CD} = \frac{4EI\theta_C}{5} - 6.25, M_{DC} = \frac{2EI\theta_C}{5} + 6.25$$

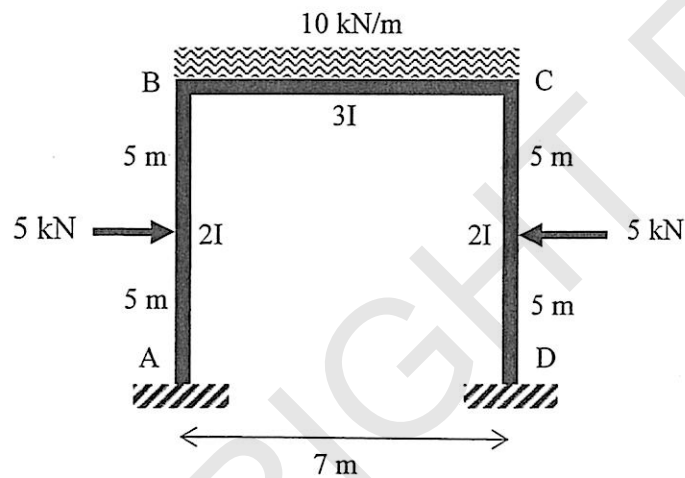


Figure B2(c) / Rajah B2(c)

- (i) Based on the Slope Deflection Equation given, calculate the value of θ_B and θ_C .

Berdasarkan Persamaan Cerun Pesongan yang diberi, kirakan nilai θ_B and θ_C .

[7 marks]

[7 markah]

- (ii) Calculate final moments at each joint.

Kirakan momen akhir pada setiap sambungan.

[8 marks]

[8 markah]

QUESTION 3**SOALAN 3**

A continuous beam is fixed at A, while supported by pins and rollers at B and C that carry a uniformly distributed load and point load as shown in Figure B3. Use the Moment Distribution Method:

Satu rasuk selanjur yang diikat tegar pada A manakala di tupang secara pin dan rola pada sokong B dan C dikenakan beban teragih seragam dan juga beban tumpu seperti yang ditunjukkan pada Rajah B3. Gunakan Kaedah Agihan Momen:

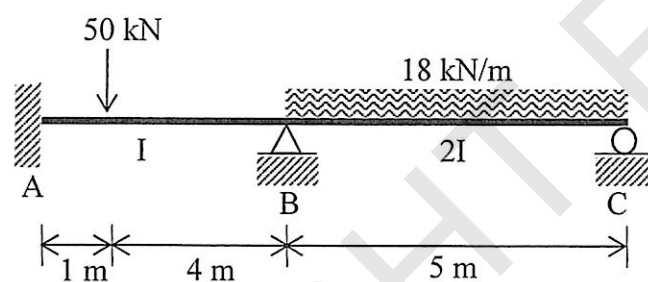


Figure B3/ Rajah B3

- CLO1 (a) Identify value of Fixed End Moment for support A, B and C in Figure B3.

Kenal pasti nilai momen hujung terikat bagi sokong A, B dan C dalam Rajah B3.

[4 marks]

[4 markah]

- CLO1 (b) Identify the distribution and stiffness factors for the beam as shown in Figure B3.

Kenal pasti factor agihan dan kekukuhan seperti yang ditunjukkan dalam Rajah B3.

[6 marks]

[6 markah]

- CLO1 (c) A continuous beam is fixed at A, while supported by pins and rollers at B and C that carry a uniformly distributed load and point load as shown in Figure B3(c). The value of Fixed End Moment and distribution factor at joint B is given as follows:

Satu rasuk selanjar yang diikat tegar pada A manakala di tupang secara pin dan rola pada sokong B dan C dikenakan beban teragih seragam dan juga beban tumpu seperti yang ditunjukkan pada Rajah B3(c). Diberi nilai momen hujung terikat dan faktor agihan pada penyokong B adalah seperti berikut:

$$FEM_{AB} = -2.22 \text{ kNm}$$

$$FEM_{BC} = -20.83 \text{ kNm}$$

$$FEM_{BA} = +1.111 \text{ kNm}$$

$$FEM_{CB} = +20.83 \text{ kNm}$$

$$DF_{BA} = 0.45$$

$$DF_{BC} = 0.55$$

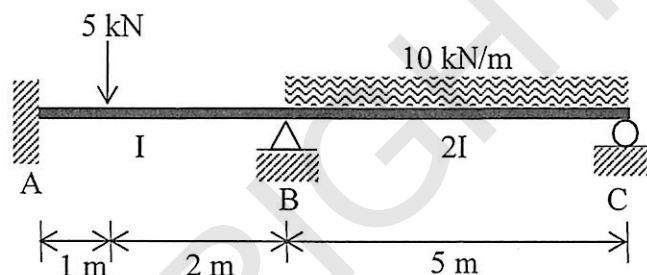


Figure B3(c) / Rajah B3(c)

- i. Calculate the final moment for each member with 4 times balancing.

Kirakan momen akhir bagi setiap anggota dengan 4 kali imbalan.

[7 marks]

[7 markah]

- ii. Sketch the Shear Force Diagram.

Lakarkan Gambarajah Daya Ricih.

[8 marks]

[8 markah]

QUESTION 4**SOALAN 4**

The portal frame shown in Figure B4 is a non-swaying portal frame. A frame is fixed at A and C carries a uniformly distribution load and point load.

Sebuah kerangka portal seperti dalam Rajah B4 merupakan bingkai portal yang tidak bergoyang. Kerangka tersebut diikat tegar pada A dan C dikenakan beban teragih seragam dan beban tumpu.

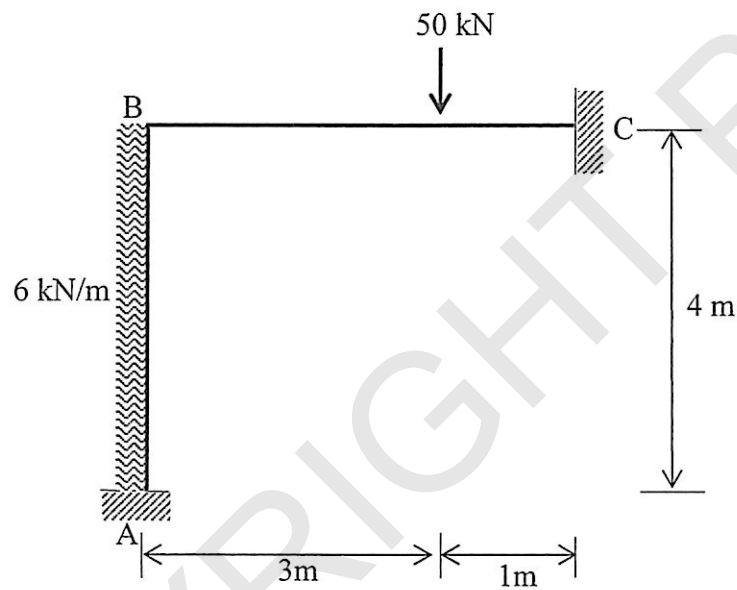


Figure B4 / Rajah B4

- CLO1 (a) Identify the factors that cause the frame sway or not to sway.

Kenal pasti faktor yang menyebabkan kerangka huyung atau tidak huyung.

[4 marks]

[4 markah]

- CLO1 (b) Identify the value of fixed end moment for portal frame in Figure B4.

Kenal pasti nilai momen hujung terikat bagi kerangka portal di Rajah B4.

[6 marks]

[6 markah]

- CLO1 (c) Based on the moment distribution method;
Berpandukan kaedah agihan momen;
- i. Calculate the distribution and stiffness factors.
Kirakan faktor agihan dan kekukuhan.
- ii. Calculate the final moment at supports.
Kirakan momen akhir pada sokong.

[7 marks]

[7 markah]

[8 marks]

[8 markah]

SOALAN TAMAT

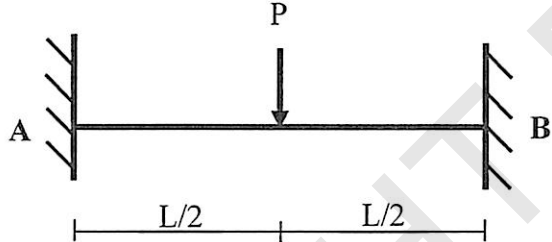
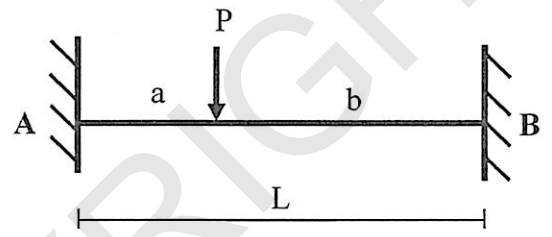
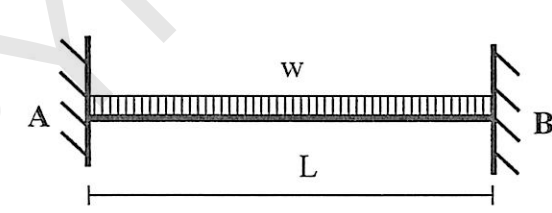
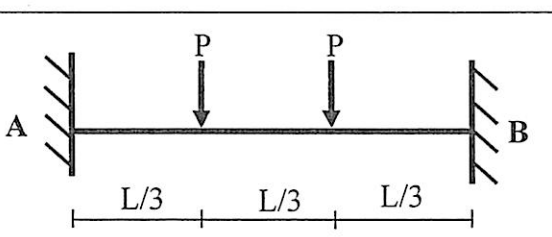
DCC40163 – THEORY OF STRUCTURE

FORMULAE

1. Slope Deflection Method

$$M_{AB} = \frac{2EI}{L} \left[2\theta_A + \theta_B - \frac{3\Delta}{L} \right] \pm M^F$$

$$M_{BA} = \frac{2EI}{L} \left[2\theta_B + \theta_A - \frac{3\Delta}{L} \right] \pm M^F$$

$M_{AB}^F = -PL/8$		$M_{BA}^F = PL/8$
$M_{AB}^F = -Pab^2/L^2$		$M_{BA}^F = Pba^2/L^2$
$M_{AB}^F = -wL^2/12$		$M_{BA}^F = wL^2/12$
$M_{AB}^F = -2PL/9$		$M_{BA}^F = 2PL/9$

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. $M_C = bx/L$, $V_C = a(1 - x/L)$