

**SULIT**



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

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR**

**SESI II : 2021/2022**

**DCC40163 : THEORY OF STRUCTURE**

**TARIKH : 27 JUN 2022**

**MASA : 02.30 PETANG – 04.30 PETANG (2 JAM)**

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Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.

Bahagian A: Struktur (3 soalan)

Bahagian B: Esei (1 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: 75 MARKS**  
**BAHAGIAN A: 75 MARKAH**

**INSTRUCTION:**

This section consists of **THREE (3)** structured questions. Answer **ALL** questions.

**ARAHAN:**

Bahagian ini mengandungi **TIGA (3)** soalan berstruktur. Jawab **SEMUA** soalan.

**QUESTION 1**

**SOALAN 1**

- (a) Figure A1(a) shows a statically indeterminate beam with two spans which are supported at A, B and C. By using Slope Deflection Method;

*Rajah A1(a) menunjukkan rasuk tidak boleh tentu statik dengan dua rentang yang disokong oleh A, B dan C. Dengan menggunakan Kaedah Cerun Pesongan;*

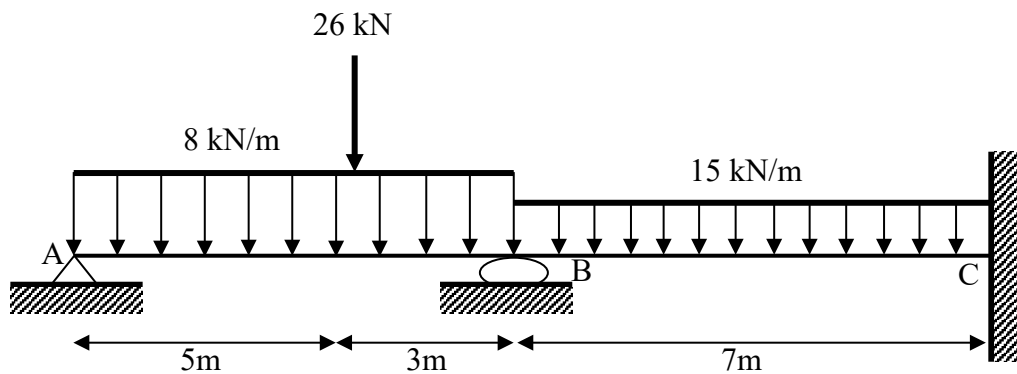


Figure A1(a) / *Rajah A1(a)*

CLO1  
C2

- i. Identify the Slope Deflection Moment for each span of the beam.  
*Kenalpasti Persamaan Cerun Pesongan bagi setiap rentang rasuk tersebut.*

[6 marks]

[6 markah]

CLO1  
C3

- ii. Calculate the degree of slope,  $\theta$  and final moment at each span.  
*Kirakan darjah kecerunan,  $\theta$  dan momen akhir bagi setiap rentang.*

[7 marks]

[7 markah]

- (b) The structure shown in Figure A1(b) is a non-swaying portal frame. Given

Moment equation:

*Struktur yang ditunjukkan dalam Rajah A1(b) adalah sebuah kerangka portal tanpa huyung. Diberi Persamaan Momen:*

$$M_{AB} = 0.3 EI [\theta_B] - 91.67$$

$$M_{BA} = 0.6 EI [\theta_B] + 91.67$$

$$M_{BC} = 1.6 EI [\theta_B] - 5$$

$$M_{CB} = 0.8 EI [\theta_B] + 5$$

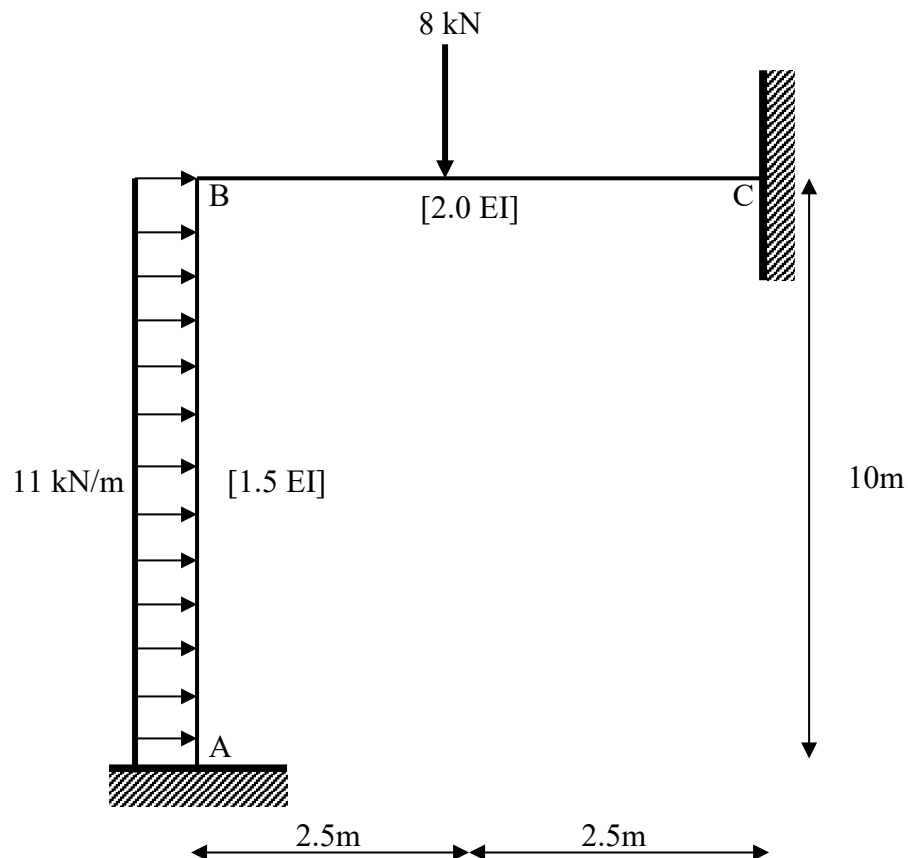


Figure A1(b) / Rajah A1(b)

CLO1  
C2

- i. Identify the final moment for each joint for the portal frame.  
*Kenalpasti momen akhir pada setiap sambungan untuk kerangka tersebut.*

[6 marks]  
[6 markah]

CLO1  
C3

- ii. Sketch the shear force diagram (SFD).  
*Lakarkan gambarajah Daya Ricih (GDR).*

[6 marks]  
[6 markah]

**QUESTION 2****SOALAN 2**

- (a) Figure A2(a) shows a continuous beam exerted with 25 kN/m uniformly distributed load and point load of 18 kN and 10 kN. Given the value of Fixed End Moment as follows:

*Rajah A2(a) menunjukkan satu rasuk selanjur dikenakan dengan beban teragih seragam sebanyak 25 kN/m dan beban titik sebanyak 18 kN dan 10 kN. Diberikan nilai Momen Hujung Terikat seperti berikut:*

$$M_{AB}^F = -8 \text{ kNm}$$

$$M_{BA}^F = 4 \text{ kNm}$$

$$M_{BC}^F = -82.5 \text{ kNm}$$

$$M_{CB}^F = 82.5 \text{ kNm}$$

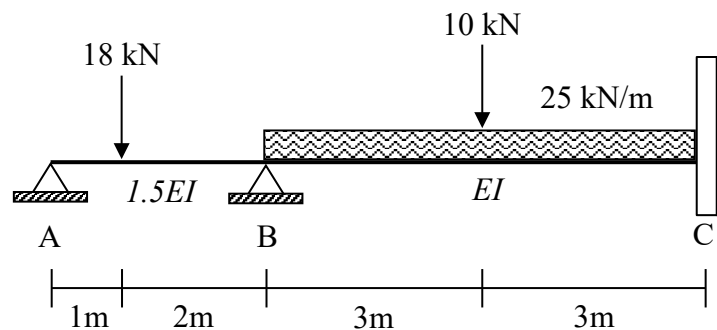


Figure A2(a) / *Rajah A2(a)*

Based on Figure A2(a),

*Berdasarkan Rajah A2(a),*

- i. Identify the Stiffness and Distribution Factor for the continuous beam.  
*Kenalpasti Kekukuhan dan Faktor Agihan bagi rasuk selanjur tersebut.*

[6 marks]

[6 markah]

CLO1  
C2

CLO1  
C3

- 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.*

[7 marks]

[7 markah]

- (b) A non-sway frame is subjected to uniformly distributed load and point load as shown in Figure A2(b). Given the value of  $EI$  is constant for each span and the value of final moment are as shown below.

*Satu kerangka tidak huyung dikenakan beban teragih seragam dan beban titik seperti ditunjukkan dalam Rajah A2(b). Diberi nilai  $EI$  adalah malar bagi setiap rentang dan nilai momen akhir adalah seperti di bawah.*

$$M_{AB} = 8.982 \text{ kNm}$$

$$M_{BA} = 28.464 \text{ kNm}$$

$$M_{BC} = -28.464 \text{ kNm}$$

$$M_{CB} = 46.036 \text{ kNm}$$

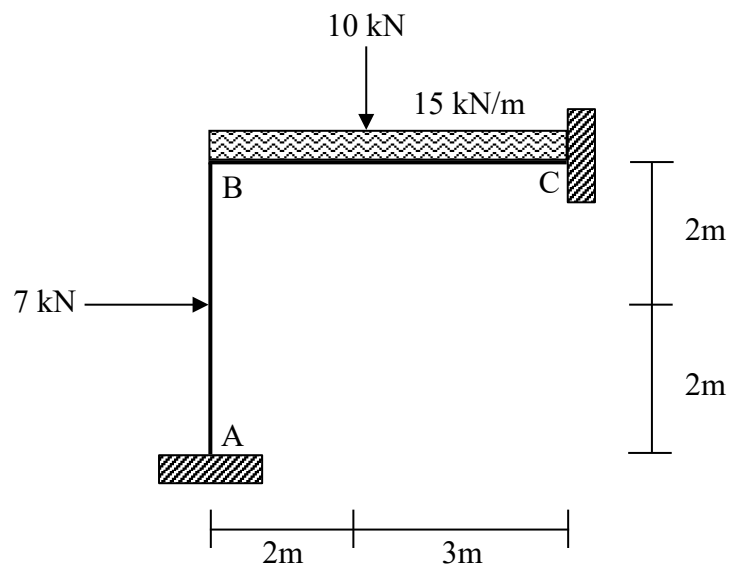


Figure A2(b) / Rajah A2(b)

By using the value of final moment,

*Dengan menggunakan nilai momen akhir,*

CLO1  
C2

- i. Identify the reactions forces at joint A, B and C.

*Kenalpasti daya-daya tindakbalas di sambungan A, B dan C.*

[6 marks]

[6 markah]

CLO1  
C3

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

*Lakarkan Gambarajah Daya Ricih bagi kerangka tersebut.*

[6 marks]

[6 markah]

**QUESTION 3****SOALAN 3**

Figure A3 shows a frame structure subjected to a horizontal load 20 kN at joint C and a vertical load of 30 kN at joint E.

*Rajah A3 di bawah menunjukkan struktur kekuda yang dikenakan beban ufuk sebanyak 20 kN pada sendi C dan beban pugak sebanyak 30 kN pada sendi E.*

CLO2  
C3

- (a) Produce the reaction at joint A and B.

*Dapatkan daya tindakbalas pada penyokong A dan B.*

[5 marks]

[5 markah]

CLO2  
C4

- (b) Calculate the internal forces at joint B, C, D and E using the Method of Joints.

*Kirakan daya dalaman pada sendi B, C, D dan E dengan menggunakan Kaedah Sendi.*

[10 marks]

[10 markah]

CLO2  
C4

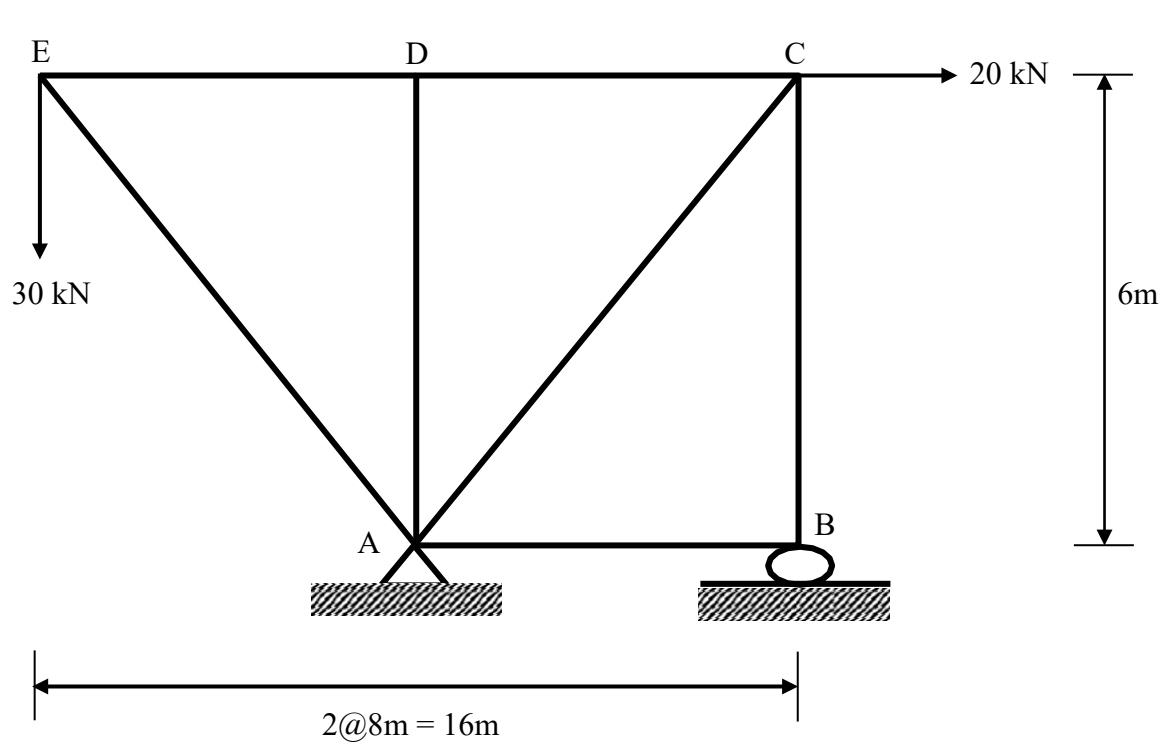
- (c) Based on the answer in Question (b), develop a diagram of truss by showing all the internal forces including the sign of force direction.

*Berdasarkan kepada jawapan Soalan (b), hasilkan gambarajah kekuda dengan menunjukkan kesemua nilai daya dalaman termasuk tanda arah.*

[10 marks]

[10 markah]



Figure A3 / *Rajah A3*

**SECTION B: 25 MARKS**  
**BAHAGIAN B: 25 MARKAH**

**INSTRUCTION:**

This section consists of **ONE (1)** essay question. Answer the question.

**ARAHAN:**

Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab soalan tersebut.

**QUESTION 1**

**SOALAN 1**

CLO3  
C4

- (a) Overhanging beam is subjected with point load and uniformly distributed load as shown in Figure B1(a). By using Influence Line Diagram method, calculate:  
*Rasuk julur dikenakan beban tumpu dan beban teragih seragam seperti yang ditunjukkan dalam Rajah B1(a). Dengan menggunakan kaedah Gambarajah Garis Imbas, kirakan:*

- i. Shear force at point C.

*Daya ricih di titik C.*

[5 marks]

[5 markah]

- ii. Bending moment at point C.

*Momen lentur di titik C.*

[5 marks]

[5 markah]

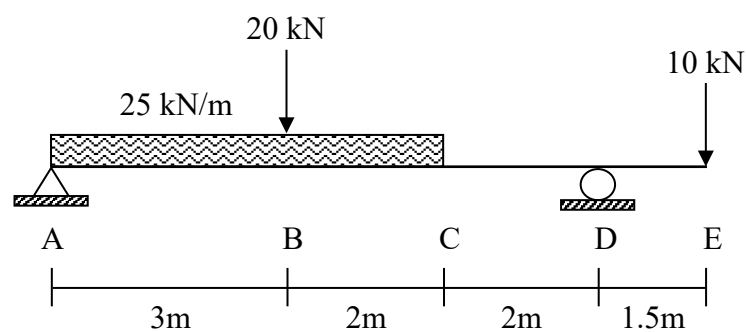


Figure B1(a) / Rajah B1(a)

CLO3  
C5

- (b) A simply supported beam in Figure B1(b) supported at A and B is subjected to a series of moving load of 10 kN, 7 kN and 5 kN respectively. By using 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 B1(b) yang disokong di A dan B dikenakan satu siri beban bergerak 10 kN, 7 kN and 5 kN. Dengan menggunakan kaedah Gambarajah Garis Imbas, nilaikan **Momen Maksimum Mutlak** yang disebabkan oleh pergerakan satu siri beban dalam satu arah kanan ke kiri.*

[15 marks]

[15 markah]

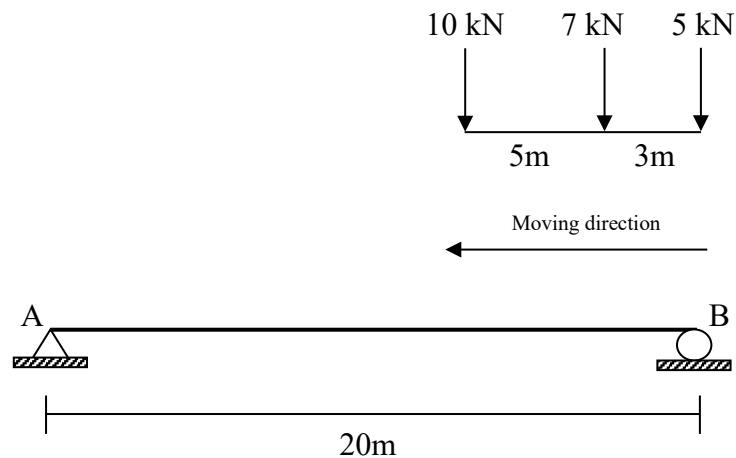


Figure B1(b) / Rajah B1(b)

**SOALAN TAMAT**

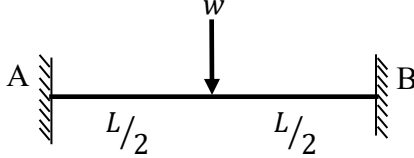
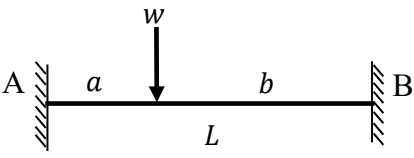
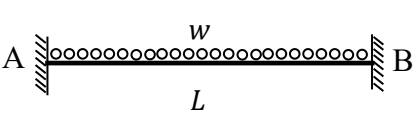
**DCC40163 – THEORY OF STRUCTURE  
FORMULAE**

**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

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