

SULIT



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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2017

DCC5163 : THEORY OF STRUCTURES

TARIKH : 21 OKTOBER 2017

TEMPOH : 2.30PETANG – 4.30PETANG(2 JAM)

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

Bahagian A: Soalan Struktur (2 soalan)

Bahagian B: Soalan Struktur (4 soalan)

Dokumen sokongan yang disertakan: **FORMULA -THEORY OF STRUCTURES**

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) structured questions. Answer ALL questions.

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan berstruktur. Jawab SEMUA soalan.

QUESTION 1

SOALAN 1

Figure A1(a) shows a continuous beam and Figure A1(b) shows a non-sway portal frame. EI is constant for each member.

Rajah A1(a) menunjukkan sebuah rasuk selanjur dan Rajah A1(b) menunjukkan kerangka portal tanpa huyung. EI adalah malar bagi setiap anggota.

CLO1
C1

- (a) Identify the Distribution Factor for statically indeterminate beam shown in Figure A1(a).

Kenalpasti Faktor Agihan bagi rasuk tidak boleh tentu statik yang ditunjukkan dalam Rajah A1(a).

[5 marks]

[5 markah]

CLO1
C2

- (b) Calculate the Fixed End Moment (FEM) for continuous beam in Figure A1(a).

Kirakan Momen Hujung Terikat bagi rasuk selanjur dalam Rajah A1(a).

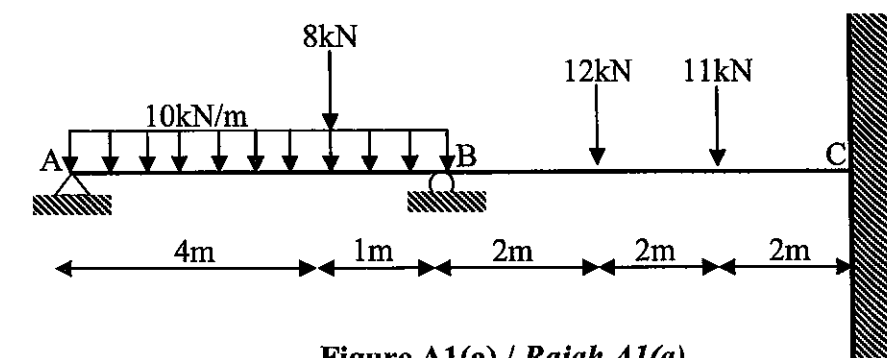


Figure A1(a) / Rajah A1(a)

[5 marks]

[5 markah]

SULIT

CLO1
C3

(c) Calculate the final moment for **Figure A1(b)** by using Moment Distribution Method (3 times of distribution) at point A, B and C. Given the value of Fixed End Moment (FEM) as shown below:

Kirakan momen akhir bagi Rajah A1(b) dengan menggunakan Kaedah Agihan Momen pada A, B, dan C dengan menggunakan Kaedah Agihan Momen (3 kali agihan). Diberi nilai momen hujung terikat seperti di bawah:

$$FEM_{AB} = -33.48 \text{ kNm}$$

$$FEM_{BA} = 33.25 \text{ kNm}$$

$$FEM_{BC} = -7.14 \text{ kNm}$$

$$FEM_{CB} = 2.86 \text{ kNm}$$

[15 marks]

[15 markah]

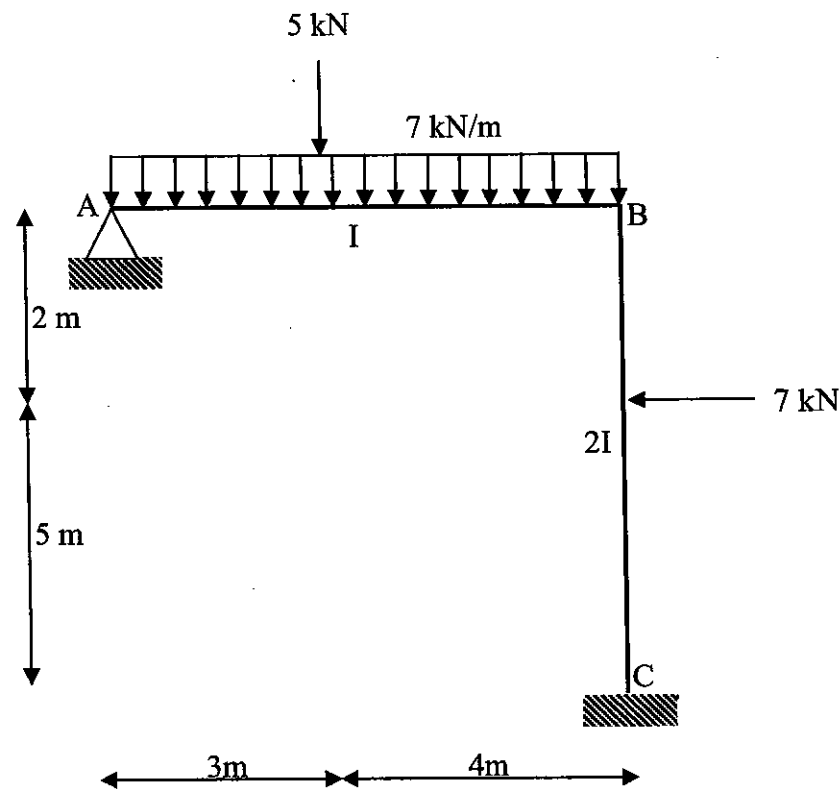


Figure A1(b)/Rajah A1(b)

QUESTION 2

SOALAN 2

A simply supported beam with a series of moving load is shown in **Figure A2(a)**. Using Influence Line Diagram Method, sketch and calculate:

Sebuah rasuk ditupang mudah dibebankan dengan satu siri beban tumpu bergerak seperti yang ditunjukkan dalam Rajah A2(a). Dengan menggunakan Kaedah Gambarajah Garis Imbas, lakar dan kirakan:

CLO3
C3

- (a) the maximum moment at point B when a series of point load with 4 kN load in front, move from A to D.
momen maksima pada titik B apabila satu siri beban tumpu dengan beban 4 kN dihadapan, bergerak daripada A ke D.

[15 marks]

[15 markah]

CLO3
C4

- (b) the Absolute Maximum Moment due to a series of moving concentrated load.
Momen maksimum mutlak yang disebabkan oleh satu siri beban tumpu yang bergerak.

[10 marks]

[10 markah]

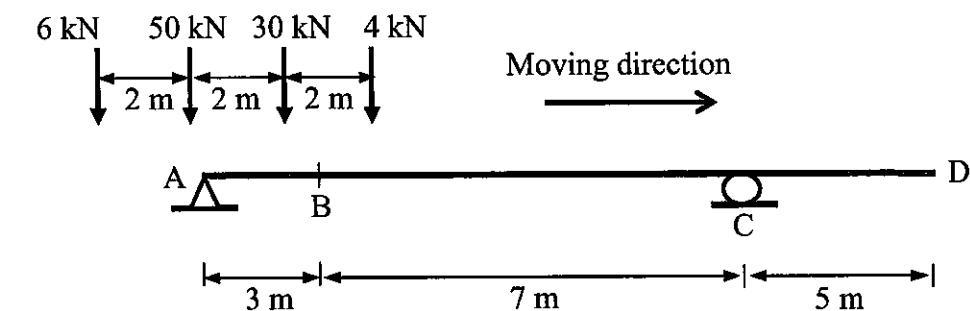


Figure A2/Rajah A2

SECTION B: 50 MARKS

BAHAGIAN B: 50 MARKAH

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

Figure B1(a) shows a continuous beam and **Figure B1(b)** shows a non sway portal frame. EI is constant for each member.

Rajah B1(a) menunjukkan sebuah rasuk selanjur dan Rajah B1(b) menunjukkan kerangka portal tanpa huyung. EI adalah malar bagi setiap anggota.

CLO1
C1

- (a) Identify the value of Fixed End Moment (FEM) for each span for **Figure B1(a)**.
Kenalpasti nilai Momen Hujung Terikat pada setiap rentang bagi Rajah B1(a).

[4 marks]

[4 markah]

CLO1
C2

- (b) Calculate the moment equation for each member for **Figure B1(a)** by using the Slope Deflection Method.

Kira persamaan momen bagi setiap anggota bagi Rajah B1(a) dengan menggunakan Kaedah Cerun Pesongan.

[8 marks]

[8 markah]

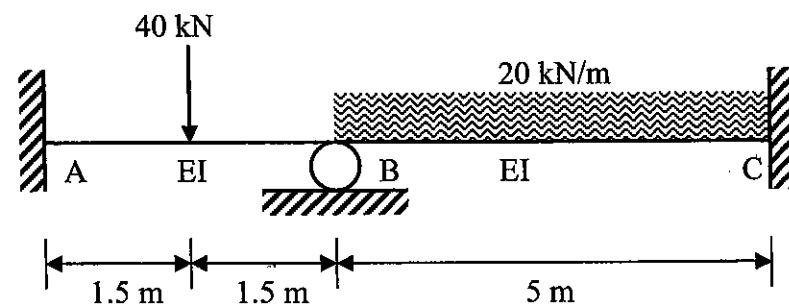


Figure B1(a)/Rajah B1(a)

CLO1
C3

- (c) Calculate the slope at B (θ_B) and C (θ_C) for **Figure B1(b)** by using the Slope Deflection Method. Given the value of Fixed End Moment (FEM) as shown below:

Kirakan cerun di B (θ_B) dan C (θ_C) bagi Rajah B1(b) dengan menggunakan Kaedah Cerun Pesongan. Diberi Momen Hujung Terikat seperti di bawah:

$FEM_{AB} = 0$	$FEM_{BA} = 0$	$FEM_{BC} = -40\text{kNm}$
$FEM_{CB} = 40\text{kNm}$	$FEM_{CD} = 0$	$FEM_{DC} = 0$

[13 marks]

[13 markah]

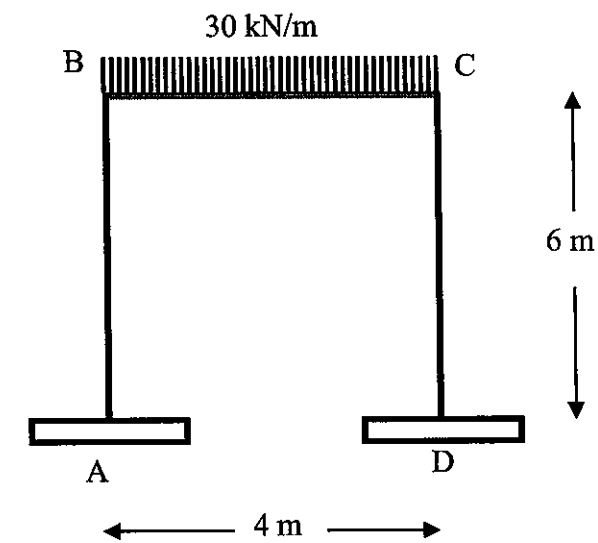


Figure B1(b)/Rajah B1(b)

QUESTION 2

SOALAN 2

CLO2
C1

(a) State the reactions at the support A and F for **Figure B2(a)**.

*Nyatakan daya tindakbalas di penyokong A dan F bagi **Rajah B2(a)**.*

[5 marks]

[5 markah]

CLO2
C2

(b) Determine the internal forces at point A for **Figure B2(a)** using Method of Joint.

*Tentukan daya dalaman di titik A bagi **Rajah B2(a)** dengan menggunakan Kaedah Sendi.*

[5 marks]

[5 markah]

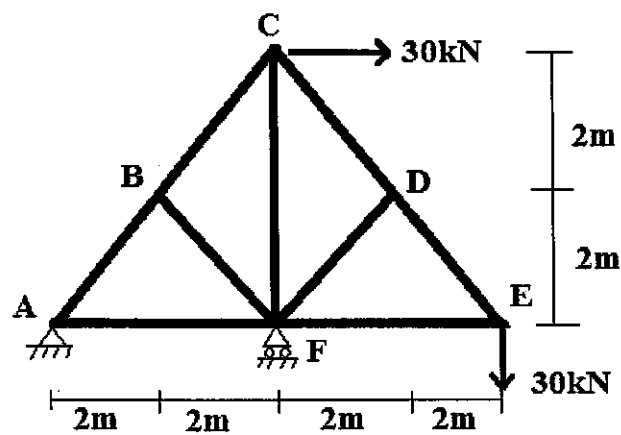


Figure B2(a) / Rajah B2(a)

CLO2
C3

(c) Calculate the internal forces of F_{HC} , F_{HG} and F_{BC} at section X-X using the Section Method as shown in **Figure B2(b)**.

*Kirakan daya dalaman bagi F_{HC} , F_{HG} and F_{BC} di keratan X-X dengan menggunakan Kaedah Keratan seperti yang ditunjukkan di dalam **Rajah B2(b)**.*

[15 marks]

[15 markah]

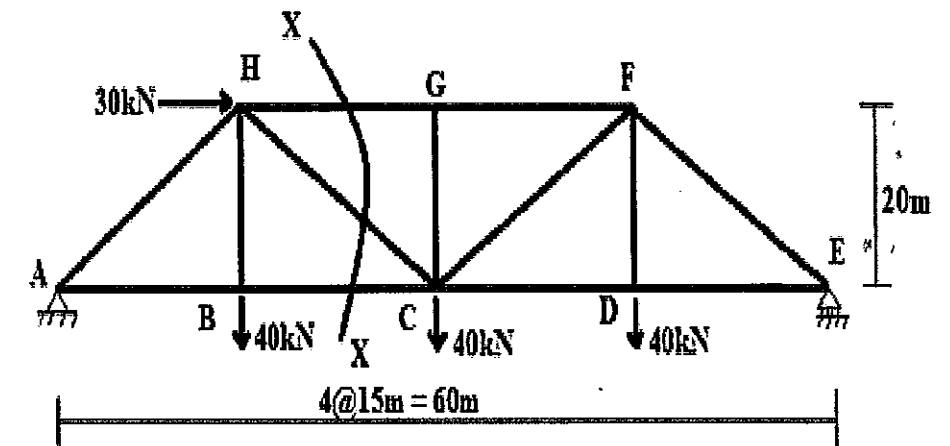


Figure B2(b) / Rajah B2(b)

QUESTION 3

SOALAN 3

A statically indeterminate truss is subjected to an external loads as shown in **Figure B3(a)**. The forces in all members due to the external load is shown in **Figure B3(b)**. The cross-sectional area, A and Modulus of Young, E are constant for each member.

Sebuah kekuda tak boleh tentu statik dikenakan beban luaran seperti ditunjukkan di dalam Rajah B3(a). Daya dalaman bagi semua anggota yang disebabkan oleh beban luar ditunjukkan di dalam Rajah B3(b). Luas keratan rentas, A dan Modulus Young, E adalah malar bagi setiap anggota.

CLO2
C1

- (a) Identify the truss is internal statically indeterminate.

Kenalpasti kekuda tersebut tak boleh tentu statik dalaman.

[4 marks]

[4 markah]

CLO2
C2

- (b) Calculate the internal force in all members of the truss due to the virtual unit load if AC member is a redundant.

Kirakan daya dalaman bagi semua anggota kekuda yang disebabkan oleh beban unit jika AC adalah anggota lelebih.

[9 marks]

[9 markah]

CLO2
C3

- (c) Calculate the internal force in all members of the truss by using magnitude of redundant,
- R
- .

Kirakan daya dalaman bagi semua anggota kekuda dengan menggunakan magnitud lelebih, R .

[12 marks]

[12 markah]

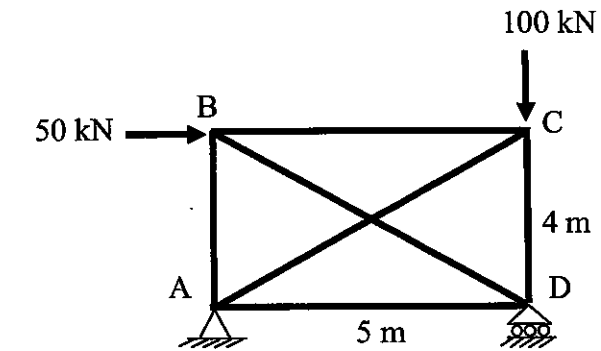


Figure B3(a) /Rajah B3(a)

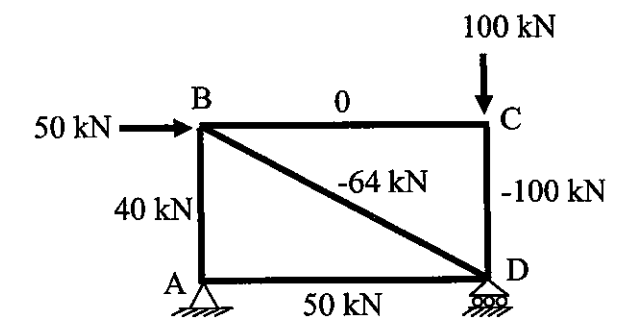


Figure B3(b)/Rajah B3(b)

QUESTION 4

SOALAN 4

A plane truss is loaded as shown in **Figure B4**. Given a cross sectional area, $A= 1000 \text{ mm}^2$ and Young's Modulus, $E= 210 \text{ Mpa}$. The internal forces in all members of plane truss due to the external load as shown in **Table B4**.

*Satu kerangka telah dibebankan seperti **Rajah B4**. Diberi luas keratan, $A= 1000 \text{ mm}^2$ dan Modulus Young, $E= 210 \text{ Mpa}$. Nilai daya dalaman bagi semua anggota kerangka adalah seperti ditunjukkan dalam **Jadual B4**.*

CLO3
C3

- (a) Calculate the internal forces in each member of the truss due to the vertical unit load at joint C.

Kirakan daya dalaman setiap anggota kuda yang disebabkan oleh beban unit pugak pada sendi C.

[10 marks]

[10 markah]

CLO3
C4

- (b) Determine the vertical displacement of joint C.

Tentukan anjakan pugak pada sendi C.

[15 marks]

[15 markah]

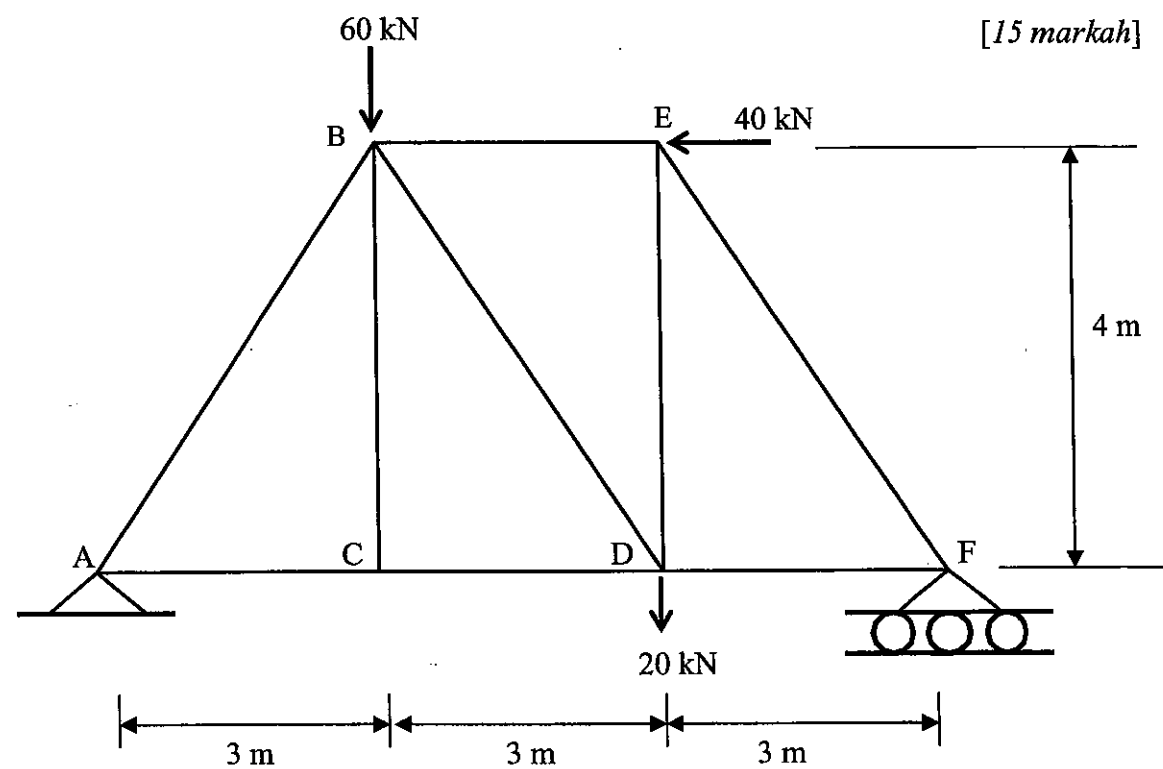


Figure B4/Rajah B4

Table B4/Jadual B4

Members	P (kN)
AB	-80.55
AC	8.33
BE	-51.67
BC	0
BD	5.55
CD	8.33
ED	15.56
EF	-19.44
DF	11.67

SOALAN TAMAT

DCC5163 – THEORY OF STRUCTURES

FORMULAE

1. Slope Deflection Method

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

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

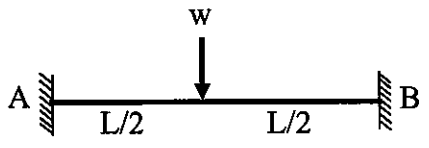
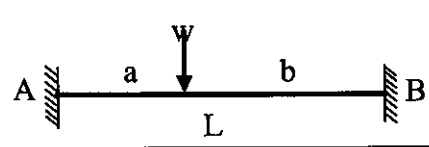
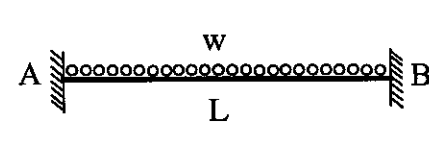
$FEM_{AB} = -\frac{wL}{8}$		$FEM_{BA} = \frac{wL}{8}$
$FEM_{AB} = -\frac{wab^2}{L^2}$		$FEM_{BA} = \frac{wa^2b}{L^2}$
$FEM_{AB} = -\frac{wL^2}{12}$		$FEM_{BA} = \frac{wL^2}{12}$

Table 1 : Fixed End Moment

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

$$DF = K / \Sigma K$$

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

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

3. Statically Indeterminate Truss

$$i. \text{ Redundant Force, } R = -\frac{\Sigma P\mu L/AE}{\Sigma \mu^2 L/AE}$$

$$ii. \text{ Internal Force, } F_i = P_i + \mu_i R$$

4. Displacement

Displacement caused due to external load, $\Delta = \Sigma P\mu L/AE$

5. Influence Lines

$$i. R_A = 1 - x/L, R_B = x/L$$

$$ii. V_c = -x/L, V_c = 1 - x/L$$

$$iii. M_c = bx/L, V_c = a(1 - x/L)$$