

SULIT



BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR  
SESI JUN 2016

DCC5163: THEORY OF STRUCTURES

---

TARIKH : 04 NOVEMBER 2016  
MASA : 8.30 AM - 10.30 AM (2 JAM)

Kertas ini mengandungi TIGA BELAS (13) halaman bercetak.

Bahagian A: Struktur (2 soalan)

Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

---

JANGAN BUKA KERTAS SOALANINI 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**

A plane truss is loaded as shown in Figure A1. All the members have the cross section area of  $350 \text{ mm}^2$  and Young Modulus, E of  $210 \text{ kN/mm}^2$ .

Satu kerangka telah dibebankan seperti Rajah A1. Jika luas keratan rentas setiap anggota kerangka tersebut  $350 \text{ mm}^2$  dan Modulus Keanjalan, E bersamaan  $210 \text{ kN/mm}^2$ .

- CLO3      C3      (a) Calculate the internal forces in the entire member of the truss due to the external loads and virtual unit loads.

*Kirakan daya dalaman bagi semua anggota kerangka tersebut disebabkan oleh beban luar dan beban unit yang dikenakan.*

[10 marks]

[10 markah]

CLO3  
C4

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

*Tentukan anjakan mendatar pada sendi C.*

[15 marks]

[15 markah]

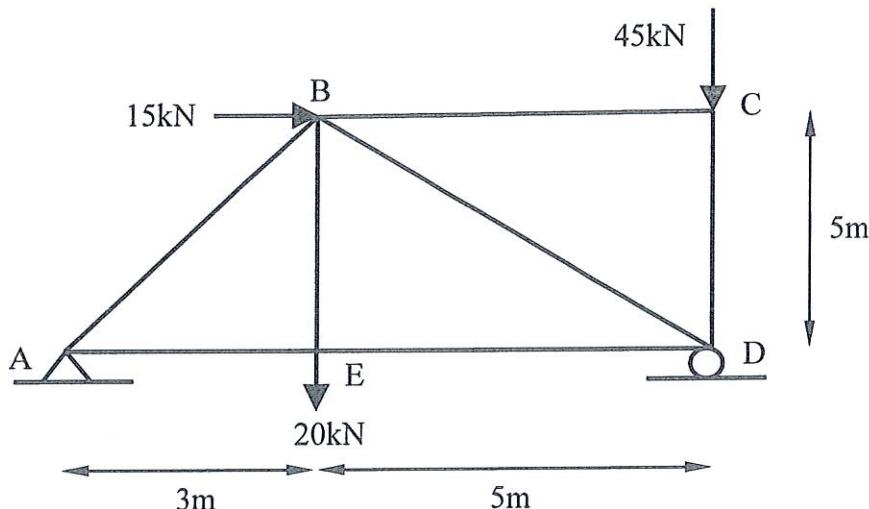


Figure A1

*Rajah A1*

## QUESTION 2

## SOALAN 2

CLO3  
C3

- (a) Overhanging beam in Figure A2(a) is carrying static load. Using Influence Line Diagram (ILD) method, draw and determine:

*Rasuk julur di dalam Rajah A2(a) menanggung beban statik. Dengan menggunakan kaedah Gambarajah Garis Imbas, lukis dan tentukan:*

- i. Reaction at support A.

*Daya tindakbalas di tupang A.*

[5 marks]

[5 markah]

- ii. Shear force at point B.

*Daya ricih di titik B.*

[5 marks]

[5 markah]

iii. Bending moment at point B.

*Momen lentur di titik B.*

*BMD*

[5 marks]

[5 markah]

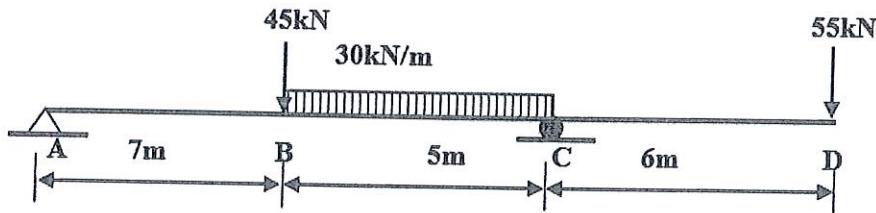


Figure A2(a)  
Rajah A2(a)

- CLO3  
C4 (b) Figure A2(b) shows a simply supported beam AB with a series of point load. Using Influence Line Diagram (ILD), determine the Absolute Maximum Moment of the beam.

*Rajah A2(b) menunjukkan rasuk tupang mudah AB beserta beban tumpu sesiri. Dengan menggunakan kaedah Gambarajah Garis Imbas, tentukan nilai momen maksimum mutlak bagi rasuk tersebut.*

[10 marks]

[10 markah]

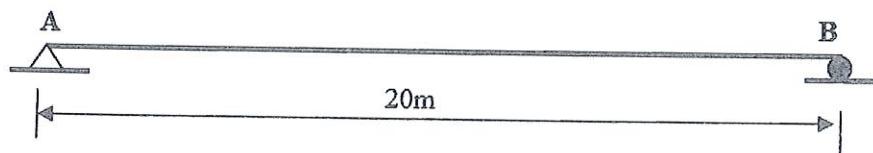
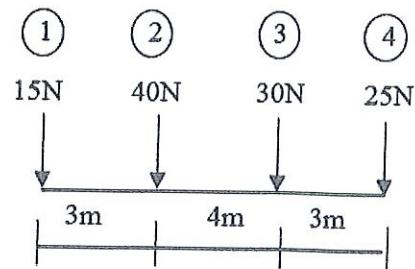


Figure A2(b)  
Rajah A2(b)

**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**

A continuous beam is fixed at A and C while supported by roller at B as shown in **Figure B1**. It carries a uniformly distributed load (UDL) of 10 kN/m over BC and point loads of 45 kN and 30 kN over AC. Use the Slope Deflection Method, if EI is constant for all members:

*Satu rasuk selanjar diikat tegar pada titik A dan C manakala ditupang roda pada titik B seperti Rajah B1. Rasuk tersebut dikenakan beban teragih seragam 10kN/m pada rentang BC dan beban tumpu 45kN and 30kN pada rentang AC. Gunakan Kaedah Cerun Pesongan, sekiranya nilai EI adalah malar untuk setiap rentang:*

- CLO1 (a) Identify the value of fixed end moment for each span.

*Kenalpasti nilai momen hujung terikat pada setiap rentang.*

[4 marks]

[4 markah]

- CLO1 (b) Calculate the final moment for each member.

*Kirakan momen akhir bagi setiap anggota.*

[8 marks]

[8 markah]

CLO1  
C3

- (c) i. Calculate the reaction force at each joint.

*Kirakan daya tindakbalas pada setiap penyokong.*

[6 marks]

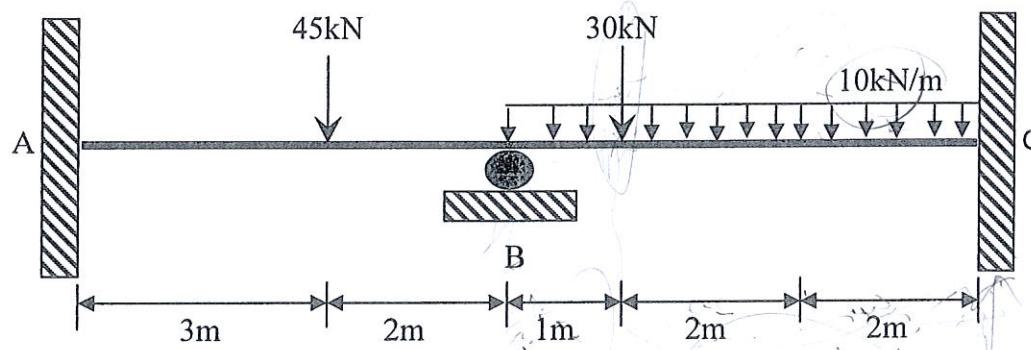
[6 markah]

- ii. Draw the shear force and bending moment diagram.

*Lukiskan gambarajah daya ricih dan momen lentur.*

[7 marks]

[7 markah]



**Figure B1**  
*Rajah B1*

## QUESTION 2

## SOALAN 2

Figure B2(a) shows a continuous beam and Figure B2(b) shows a non-sway portal frame. EI is constant for each member.

*Rajah B2(a) menunjukkan sebuah rasuk selanjar dan Rajah B2(b) menunjukkan kerangka portal tanpa hujung. EI adalah malar bagi setiap anggota.*

- CLO1      (a) Identify the Stiffness Factor for statically indeterminate beam as shown in Figure B2(a).

*Kenalpasti Faktor Kekuahan bagi rasuk tak boleh tentu statik yang ditunjukkan dalam Rajah B2(a).*

[5 marks]

[5 markah]

- CLO1      (b) Calculate the Distribution Factor for continuous beam as shown in Figure B2(a).

*Kirakan Faktor Agihan bagi rasuk selanjar yang ditunjukkan dalam Rajah B2(a).*

[5 marks]

[5 markah]

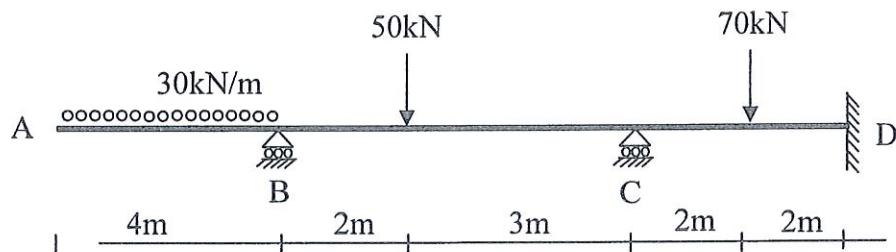


Figure B2(a)  
Rajah B2(a)

CLO1  
C3

- (c) Calculate the Final Moment for **Figure B2(b)** by using the Moment Distribution Method at point A, B, C and D (3 times of distribution). Given the value of Distribution Factor as shown below:

*Kirakan Momen Akhir bagi Rajah B2(b) dengan menggunakan Kaedah Agihan Momen di titik A, B, C dan D (3 kali agihan). Diberi Faktor Agihan seperti dibawah:*

$$DF_{AB} = 0,$$

$$DF_{BA} = 0.4,$$

$$DF_{BC} = 0.6,$$

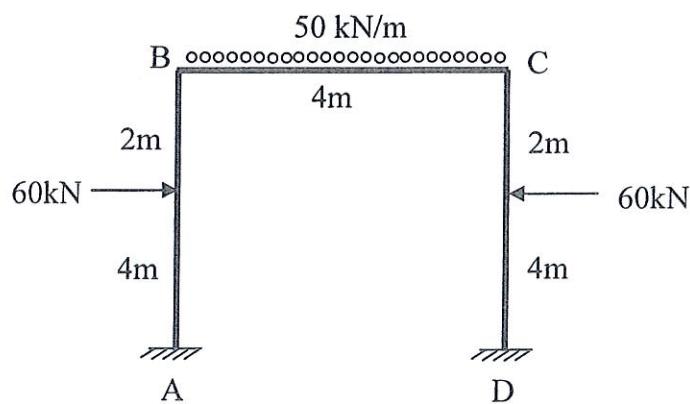
$$DF_{CB} = 0.6,$$

$$DF_{CD} = 0.4,$$

$$DF_{DC} = 0.$$

[15 marks]

[15 markah]



**Figure B2(b)**  
*Rajah B2(b)*

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

- CLO2      a) State all the members of the truss shown in **Figure B3(a)** below that have zero force.

*Nyatakan semua anggota dalaman kerangka seperti **Rajah B3(a)** yang mempunyai daya dalaman sifar.*

[5 marks]

[5 markah]

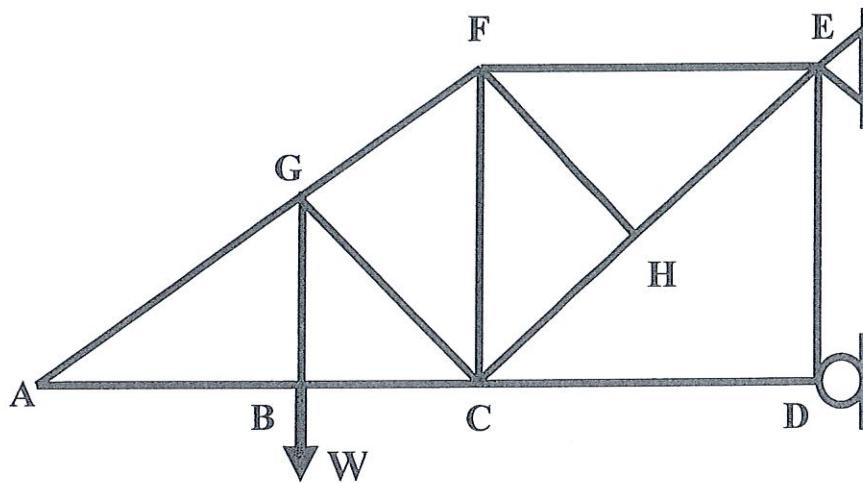


Figure B3(a)  
*Rajah B3(a)*

CLO2  
C2

- (b) Identify the forces in members BC and BE of the loaded truss shown in Figure B3(b) by using the method of section. State whether the internal forces is tension or compression.

Kenalpasti daya dalaman anggota BC dan BE untuk kerangka di dalam Rajah B3(b) dengan menggunakan kaedah keratan. Nyatakan daya dalaman anggota tersebut samada tegangan atau mampatan.

[5 marks]

[5 markah]

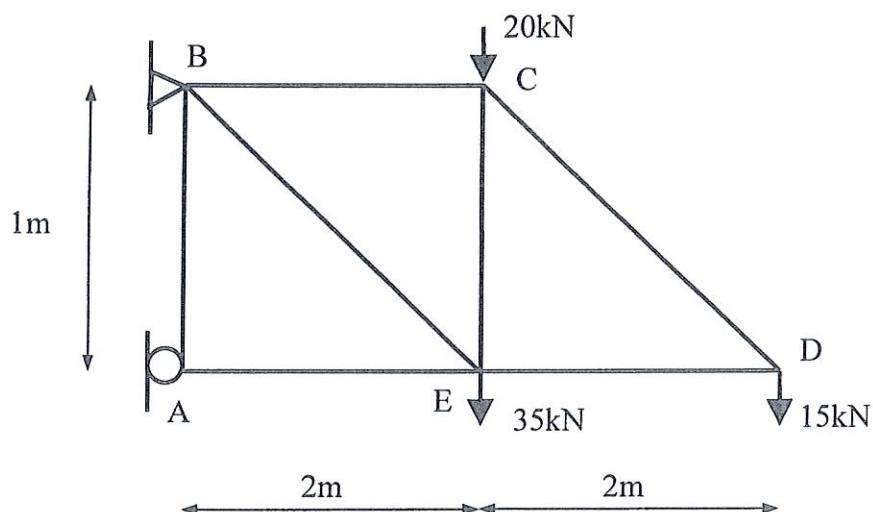


Figure B3(b)  
Rajah B3(b)

CLO2  
C3

- (c) By using Method of Joint, determine the internal forces in all of the members of the truss shown in Figure B3(c) due to the external loads. Member FE and ED have an equal length. State whether the internal forces is tension or compression.

*Dengan menggunakan kaedah sendi, tentukan daya dalaman bagi semua anggota kerangka dalam Rajah B3(c) dibawah akibat beban yang dikenakan. Anggota FE dan ED mempunyai ukuran panjang yang sama. Nyatakan daya dalam anggota tersebut samada tegangan atau mampatan.*

[15 marks]

[15 markah]

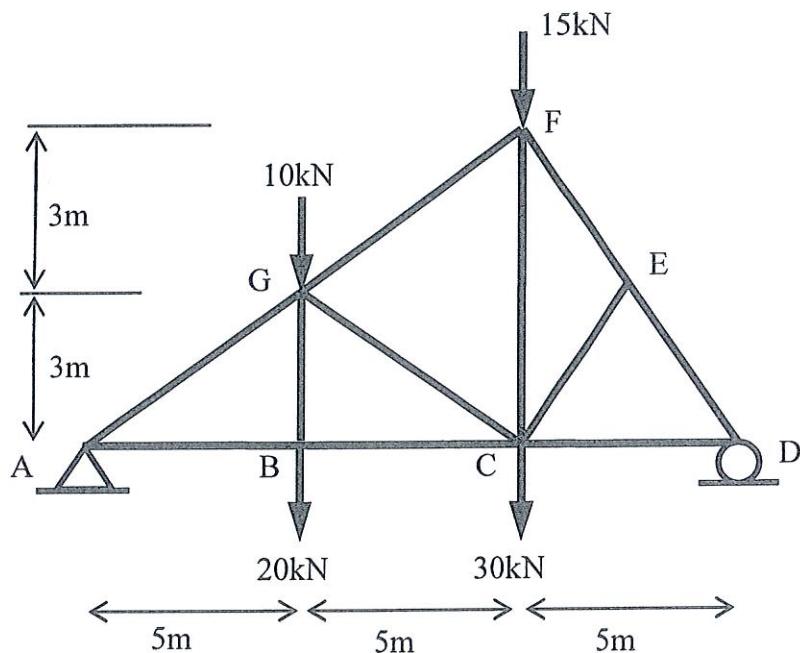


Figure B3(c)  
Rajah B3(c)

## QUESTION 4

## SOALAN 4

A simply supported truss is subjected to a horizontal axial load as shown in Figure B4. Given the cross sectional area, A and the modulus elasticity, E is constant in each member of the truss.

*Kekuda disokong mudah dikenakan beban tumpu mengufuk seperti ditunjukkan di dalam Rajah B4. Diberi luas keratan rentas, A dan modulus keanjalan, E adalah malar bagi setiap anggota kekuda.*

CLO2  
C1

- (a) State the value of reaction at support A and B .

*Tentukan nilai tindakbalas pada penyokong A dan B.*

[4 marks]

[4 markah]

CLO2  
C2

(b)

- i. Compute the force in all members of the truss due to the external load if BD member is a redundant.

*Kirakan daya dalaman bagi semua anggota kekuda yang disebabkan oleh beban luar jika anggota BD adalah lelebih.*

[4 marks]

[4 markah]

- ii. Calculate the internal forces in all members of the truss due to the virtual unit load at BD member.

*Kirakan daya dalaman bagi semua anggota kekuda yang disebabkan oleh beban unit di anggota BD.*

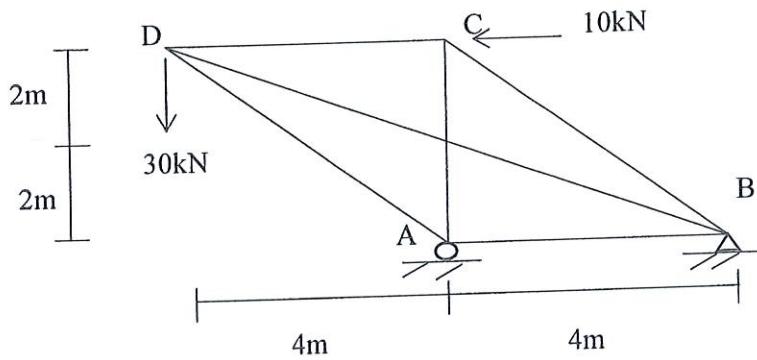
[5 marks]

[5 markah]

CLO2  
C3

- (c) Calculate the actual 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.*



**Figure B4(a)**

*Rajah B4(a)*

[12 marks]  
[12 markah]

**SOALAN TAMAT**

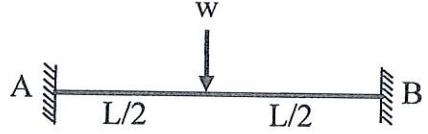
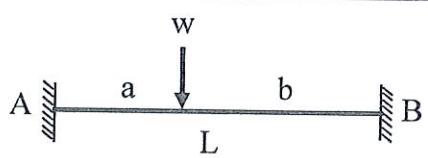
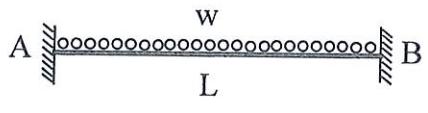
## FORMULA

## 1. Slope Deflection Method

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

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

Table 1 : Fixed End Moment

$M^F_{AB} = -\frac{wL}{8}$		$M^F_{BA} = \frac{wL}{8}$
$M^F_{AB} = -\frac{wab^2}{L^2}$		$M^F_{BA} = \frac{w a^2 b}{L^2}$
$M^F_{AB} = -\frac{wL^2}{12}$		$M^F_{BA} = \frac{wL^2}{12}$

## 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

$$\text{i. Redundant Force, } R = \frac{\sum P_i \mu_i L / AE}{\sum \mu_i^2 L / AE}$$

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

**FORMULA****4. Displacement**

Displacement caused due to:

- i. external load,

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

- ii. temperature change,

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

- iii. fabrication error,

$$\Delta = \Sigma \mu \lambda$$

**5. Influence Lines**

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