4

SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI DISEMBER 2016

DCC5163 : THEORY OF STRUCTURES

TARIKH : 01 APRIL 2017
MASA : 2.30 PM - 4.30 PM (2 JAM)

Kertas ini mengandungi **TIGA BELAS (13)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : Tiada

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 selanjar dan* ***Rajah A1 (b)*** *menunjukkan kerangka portal tanpa huyung. EI adalah malar bagi setiap anggota.*

CLO1
C1

(a) Identify the Fixed End Moment (FEM) for the continuous beam shown in **Figure A1(a)** for each of the member.
Kenalpasti Momen Hujung Terikat untuk rasuk selanjar dalam ***Rajah A1 (a)*** *untuk setiap anggotanya.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Calculate the Stiffness Factor and the Distribution Factor for the continuous beam in **Figure A1 (a)**.
Kirakan Faktor Kekukuhan dan Faktor Agihan untuk rasuk selanjar dalam ***Rajah A1(a)***.

[5 marks]
[*5 markah*]

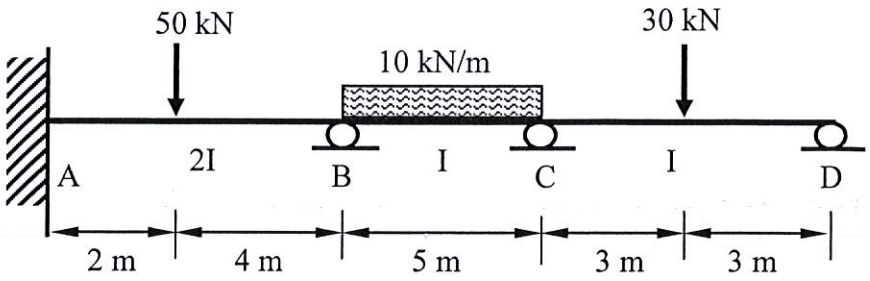


Figure A1(a)/*Rajah A1(a)*

CLO1
C3

(c) Calculate the final moment for **Figure A1(b)** by using Moment Distribution Method (4 times of distribution) at point A, B, C and D. The value of Distribution Factor and Fixed End Moment are given in **Table A1**.

*Kirakan momen akhir pada A, B, C dan D dengan menggunakan Kaedah Agihan Momen (4 kali agihan). Diberikan nilai Faktor Agihan dan Momen Hujung Terikat dalam **Jadual A1**.*

[15 marks]
[*15 markah*]

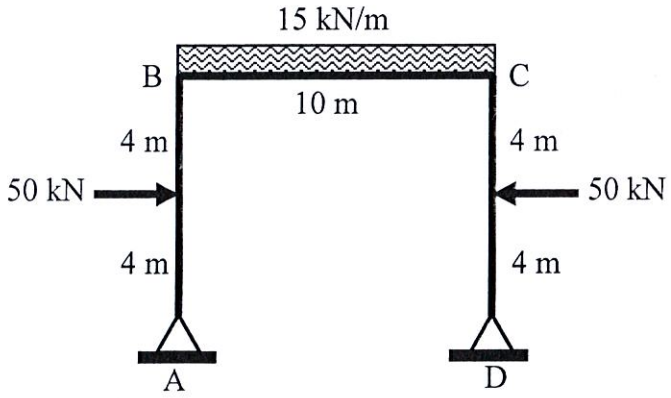


Figure A1(b)/*Rajah A1(b)*

Table A1/*Jadual A1*

Member	AB	BA	BC	CB	CD	DC
Distribution Factor	1	0.48	0.52	0.52	0.48	1
F.E.M. (kNm)	-50	+50	-125	+125	-50	+50

QUESTION 2
SOALAN 2

CLO3
C3

(a) Overhanging beam subjected with point load and uniformly distributed load is shown in **Figure A2 (a)**. By using Influence Line Diagram Method, sketch and calculate:

*Rasuk julur dibebankan dengan beban tumpu dan beban teragih seragam seperti yang ditunjukkan dalam **Rajah A2(a)**. Dengan menggunakan Kaedah Gambarajah Garis Imbas, lakar dan kirakan:*

i) Reaction force at support D
Daya tindakbalas di tupang D

[5 marks]
[*5 markah*]

ii) Shear force at point C
Daya ricih di titik C

[5 marks]
[*5 markah*]

iii) Bending moment at point C
Momen lentur di titik C

[5 marks]
[*5 markah*]

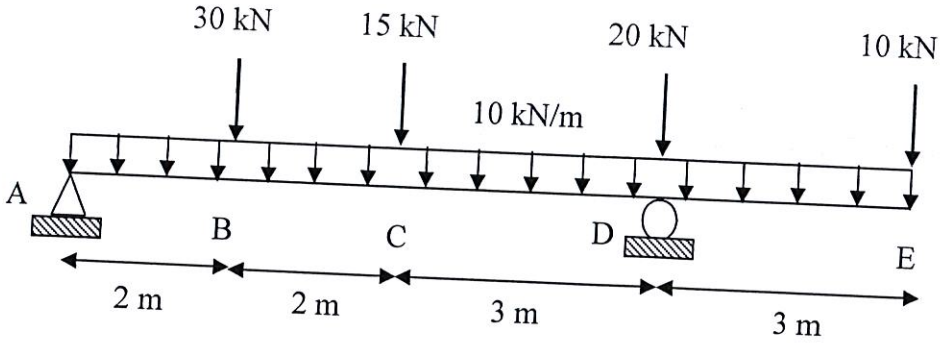


Figure A2(a)/*Rajah A2(a)*

CLO3
C4

(b) A simply supported beam is imposed with uniformly distributed load and moving from A to B as shown in **Figure A2(b)**. By using Influence Line Method, determine the maximum shear force and maximum bending moment at point C.

*Satu rasuk sokong mudah dikenakan beban teragih seragam dan bergerak dari A ke B seperti dalam **Rajah A2(b)**. Dengan menggunakan Kaedah Garis Imbas, tentukan daya ricih dan momen lentur maksima di titik C.*

[10 marks]
[*10 markah*]

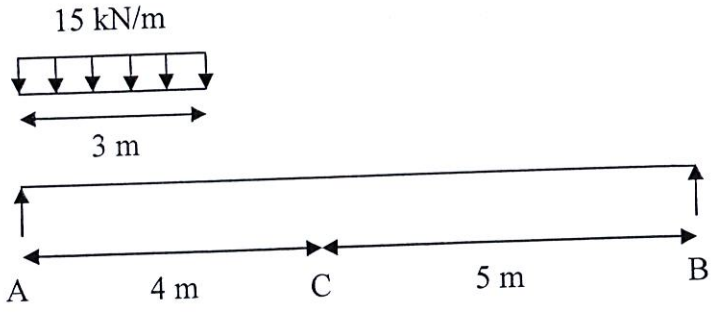


Figure A2(b)/*Rajah A2(b)*

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 while at point B and C is supported by a roller as shown in **Figure B1(a)**. The beam is subjected with a uniformly distributed load (UDL) of 20 kN/m over AB and point load of 30 kN over BC. If EI is constant for all members, using the Slope Deflection Method,:
*Satu rasuk selanjar diikat tegar pada titik A manakala pada titik B dan C ditupang roda seperti **Rajah B1(a)**. Rasuk tersebut dikenakan beban teragih seragam 20 kN/m pada rentang AB dan beban tumpu 30 kN pada rentang BC. Sekiranya nilai EI adalah malar untuk semua ahli, dengan menggunakan Kaedah Cerun Pesongan,:*

CLO1 C1 (a) Identify the value of fixed end moment for each span.
Kenalpasti nilai momen hujung terikat bagi setiap rentang

[4 marks]
[*4 markah*]

CLO1 C2 (b) Calculate the slope at point B (θ_B) and C (θ_C).
Kirakan pesongan pada titik B (θ_B) dan C (θ_C).

[8 marks]
[*8 markah*]

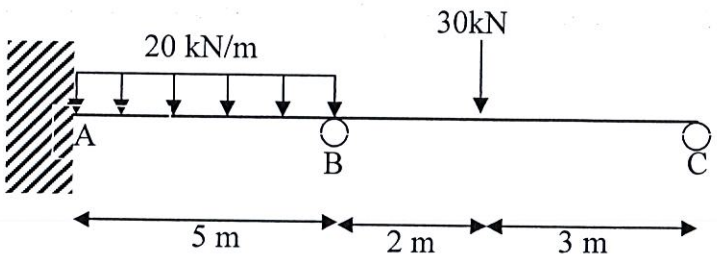


Figure B1 (a)/*Rajah B1 (a)*

CLO1
C3

(c) Calculate the slope at B (θ_B) and final moment of each member for **Figure B1 (b)** by using the Slope Deflection Method.

*Kirakan cerun di B (θ_B) dan momen akhir bagi setiap member bagi **Rajah B1(b)** dengan menggunakan Kaedah Cerun Pesongan.*

[13 marks]
[*13 markah*]

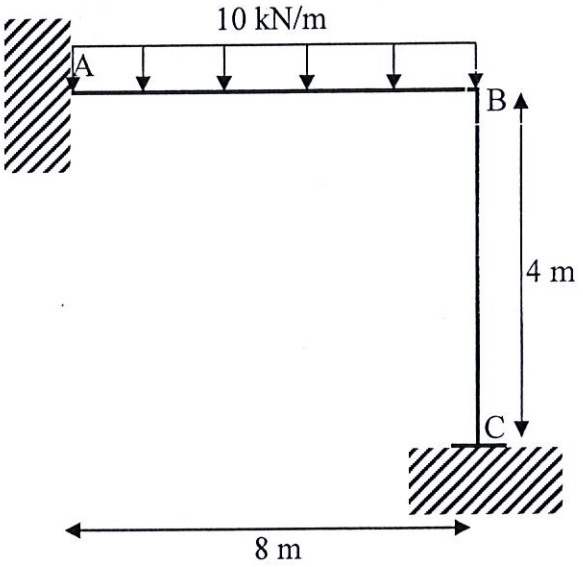


Figure B1(b)/*Rajah B1(b)*

QUESTION 2
SOALAN 2

CLO2
C1

(a) List **FIVE (5)** common types of trusses.
*Berikan **LIMA (5)** jenis kekuda yang biasa.*

[5 marks]
[*5 markah*]

CLO2
C2

(b) Identify whether the truss shown in **Figure B2** is statically determinate or indeterminate.
*Kenalpasti sama ada kekuda seperti **Rajah B2** adalah boleh tentu statik atau tidak boleh tentu statik.*

m+r - 2j

[5 marks]
[*5 markah*]

CLO2
C3

(c) Calculate the internal forces for each member of the truss by using Joint Method. State whether the internal forces is tension or compression.
Kirakan daya dalaman bagi setiap anggota kekuda dengan menggunakan Kaedah Sendi. Nyatakan sama ada daya dalaman adalah tegangan atau mampatan.

[15 marks]
[*15 markah*]

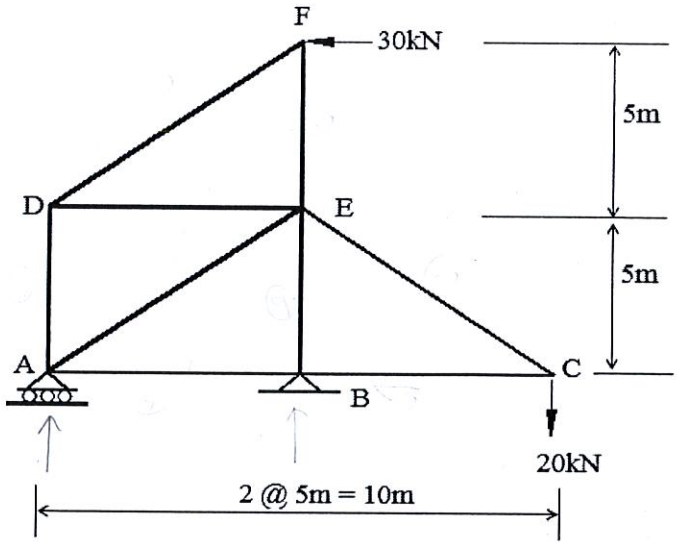


Figure B2 /*Rajah B2*

QUESTION 3
SOALAN 3

A simply supported truss is subjected to a horizontal axial load as shown in **Figure B3**. The cross sectional area, A is 15 cm^2 and the modulus elasticity, E is 200 kN/mm^2 in each member of the truss.
*Kekuda disokong mudah dikenakan beban tumpu mengufuk seperti ditunjukkan di dalam **Rajah B3**. Diberi luas keratan rentas, A adalah 15 cm^2 dan modulus keanjalan, E adalah 200 kN/mm^2.*

CLO2 C1 (a) Identify the value of reactions at supports A and D.
Kenalpasti nilai daya tindakbalas pada penyokong A dan D.

[4 marks]
[*4 markah*]

CLO2 C2 (b) i. Compute the internal force for all members of the truss due to the external load if AC member is a redundant.
Kirakan daya dalaman bagi semua anggota kekuda yang disebabkan oleh beban luar jika anggota AC adalah lelebih.

[4 marks]
[*4 markah*]

ii. Calculate the internal forces for all members of the truss due to the virtual unit load at AC member.
Kirakan daya dalaman bagi semua anggota kekuda yang disebabkan oleh beban unit di anggota AC.

[5 marks]
[*5 markah*]

CLO2
C3

(c) Calculate the internal force for 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*]

A = 15 cm²

E = 200 kN/mm²

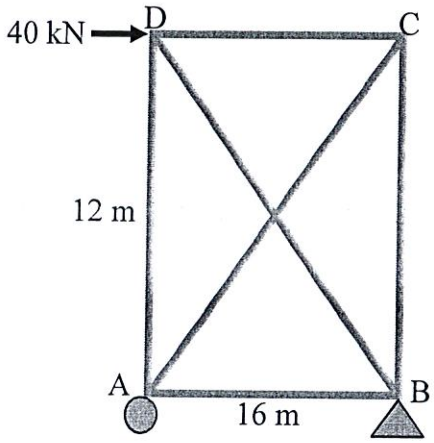


Figure B3/ *Rajah B3*

QUESTION 4
SOALAN 4

A statically determinate truss is subjected to external loads as shown in **Figure B4**. Given a cross sectional area, A= 400 mm^2 and modulus of elasticity, E= 200 kN/mm^2.

*Sebuah kekuda boleh tentu statik dikenakan beban luaran seperti ditunjukkan dalam **Rajah B4**. Diberi luas keratan, A= 400 mm^2 dan modulus keanjalan, E= 200 kN/mm^2.*

CLO3
C3

(a) Calculate the internal forces in each member of the truss due to the external load and a vertical unit load at joint B.
Kirakan daya dalaman setiap anggota kekuda yang disebabkan oleh daya luaran dan beban unit pugak pada sendi B.

[10 marks]
[*10 markah*]

CLO3
C4

(b) Determine the vertical displacement of joint B.
Tentukan anjakan pugak pada sendi B.

[15 marks]
[*15 markah*]

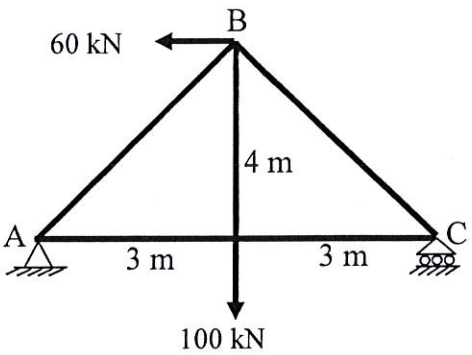


Figure B4/*Rajah B4*

SOALAN TAMAT

DCC5163 – THEORY OF STRUCTURES

FORMULAE

1. Slope Deflection Method

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

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

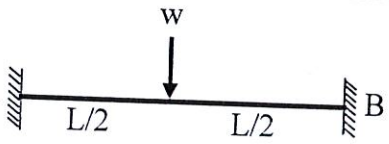
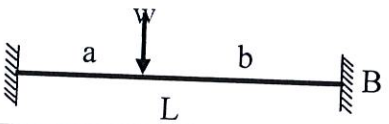
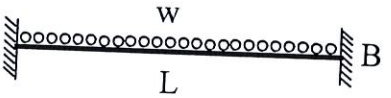
$FEM_{AB} = -\frac{wL}{8}$		$FEM_{BA} = \frac{wL}{8}$
$FEM_{AB} = -\frac{wab^2}{L^2}$		$FEM_{BA} = \frac{w\,a^2b}{L^2}$
$FEM_{AB} = -\frac{wL^2}{12}$		$FEM_{BA} = \frac{wL^2}{12}$

Table 1 : Fixed End Moment

2. Moment Distribution Method

i. Stiffness Factor

$K = 4EI/L$ (for Fixed or Continuous)

$K = 3EI/L$ (for Pinned or Roller)

ii. Distribution Factor

$DF = K / \Sigma K$

$DF = 0$ (for Fixed)

$DF = 1$ (for Pinned or Roller)

3. Statically Indeterminate Truss

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

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

iii. $Mc = bx/L$, $Vc = a(1 - x/L)$