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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DCC40163: THEORY OF STRUCTURES

TARIKH : 14 DISEMBER 2022
MASA : 02.30 PETANG - 04.30 PETANG (2 JAM)

Kertas ini mengandungi **EMPAT BELAS (14)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Esei (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)** structure questions. Answers **ALL** questions.

ARAHAN:

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

QUESTION 1
SOALAN 1

(a)   A statically determinate truss is subjected to the external loads as shown in
        Figure A1(a).The truss is subjected to a horizontal load of 80 kN at joint F.

        Sebuah kekuda boleh tentu statik dikenakan beban luaran seperti ditunjukkan
        *dalam **Rajah A1(a)**. Kekuda dikenakankan beban horizontal 80 kN pada sendi*
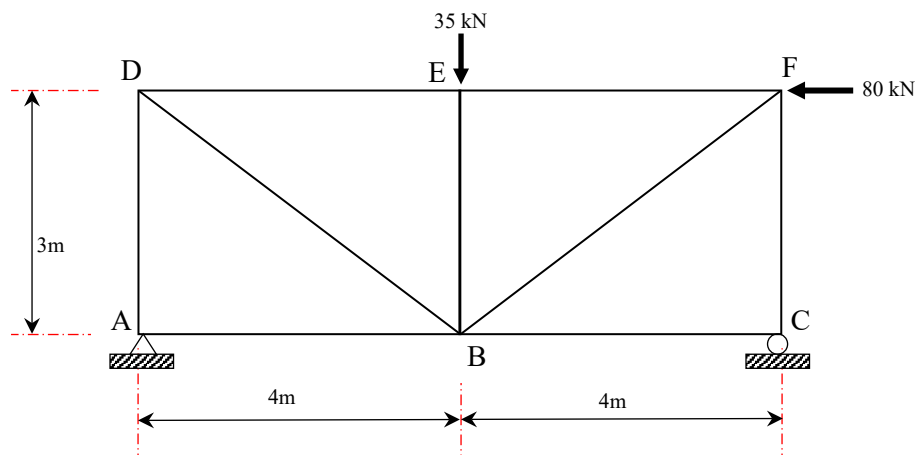   *F.*

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

CLO2   i.   Identify the type of truss
C2   *Tentukan jenis kekuda*

                                                                [6 marks]
                                                                [6 *markah*]

CLO2
C3

    ii.   Calculate the reaction at support A and C

             Kirakan daya tindak balas pada sokong A dan C

[6 marks]

[6 *markah*]

CLO2
C4

(b)   A statically determinate truss is subjected to the external loads as shown in **Figure A1(b)**. Given the 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 A1(b)**. Diberi luas keratan, A = 400 mm^2 dan modulus elastik, E = 200 kN/mm^2.*
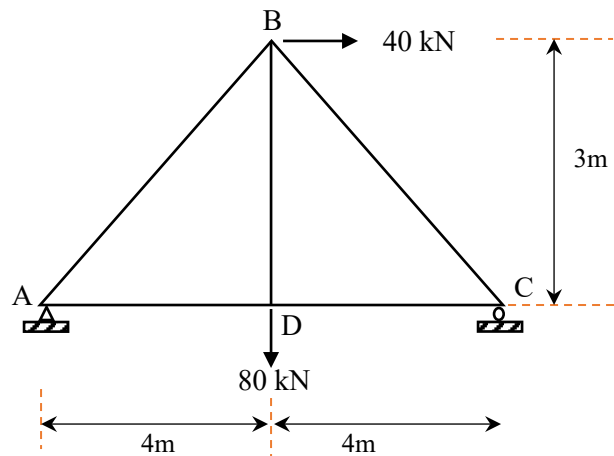

Figure A1(b) / *Rajah A1(b)*

i.   Calculate the internal force in each member of the truss due to external loads

Kirakan daya dalaman akibat beban luaran pada setiap ahli dalam kerangka.

[7 marks]

[7 *markah*]

ii.   Illustrate the compression and tension forces in each member of the truss due to external loads

Lakarkan daya mampatan dan tegangan akibat beban luaran untuk setiap ahli dalam kerangka

[6 marks]

[6 *markah*]

QUESTION 2
SOALAN 2

CLO3
C4

(a)   An overhang beam is subjected to the external loads as shown in **Figure A2(a)**.
       According to the Influence Line Diagram;

       *Satu rasuk julur dikenakan beban luaran seperti **Rajah A2(a).** Menggunakan*
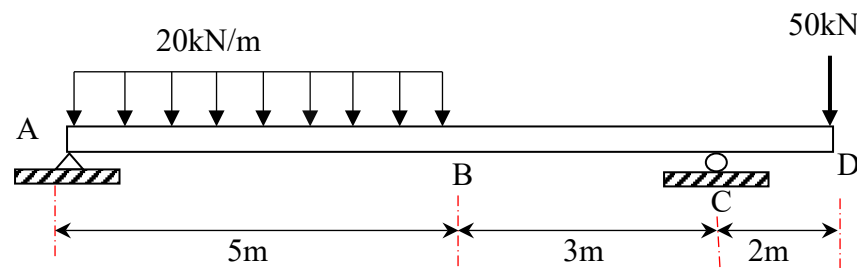   *Gambarajah Garis Imbas,*

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

       i.   Calculate the reaction at A and C
              Kirakan tindakbalas pada A and C

                                                              [5 marks]
                                                              [5 *markah*]

       ii.   Calculate the shear force at B
              Kirakan daya ricih pada B

                                                              [5 marks]
                                                              [5 *markah*]

CLO3
C5

(b)   **Figure A2(b)** shows a simply supported beam of 14 m span subjected to a series of concentrated loads. By using Influence Line Diagram, verify the absolute maximum moment occurring under the 35 kN load.

Rajah A2(b) menunjukkan satu rasuk disokong mudah sepanjang 14 m rentang yang dikenakan satu siri beban. Dengan menggunakan Gambarajah Garis Imbas, buktikan momen maksimum mutlak berlaku di bawah beban 35 kN.
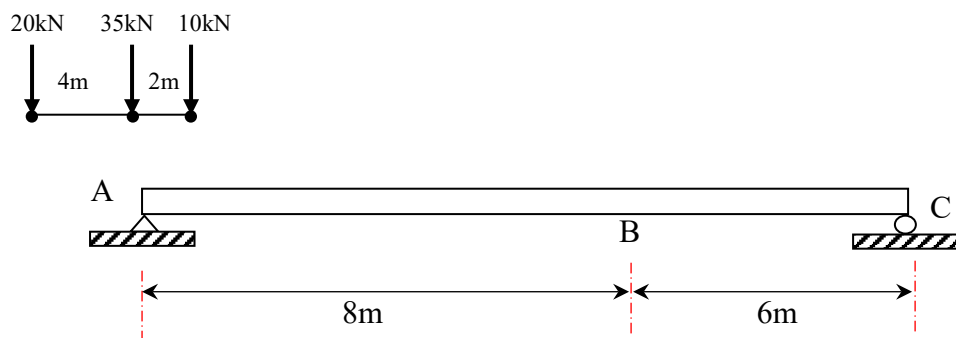
[15 marks]

[15 *markah*]

20kN   35kN   10kN

4m   2m

A

B   C

8m   6m

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

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1
SOALAN 1

A continuous beam is built in at support A while at B and C each is supported by a pin and a roller as shown in **Figure B1**. The beam carries a uniformly distributed load of 25 kN/m along AC and point load of 30 kN at span AB. EI is constant for all members. According to the Slope Deflection Method :

*Satu rasuk selanjar yang diikat tegar pada titik A manakala pada titik B dan C masing-masing ditupang secara pin dan rola seperti dalam **Rajah B1**. Rasuk dikenakan beban teragih seragam 25kN/m disepanjang rentang AC dan beban tumpu 30 kN pada rentang AB. Nilai EI adalah malar untuk setiap rentang. Berpandukan Keadah Cerun Pesongan ;*
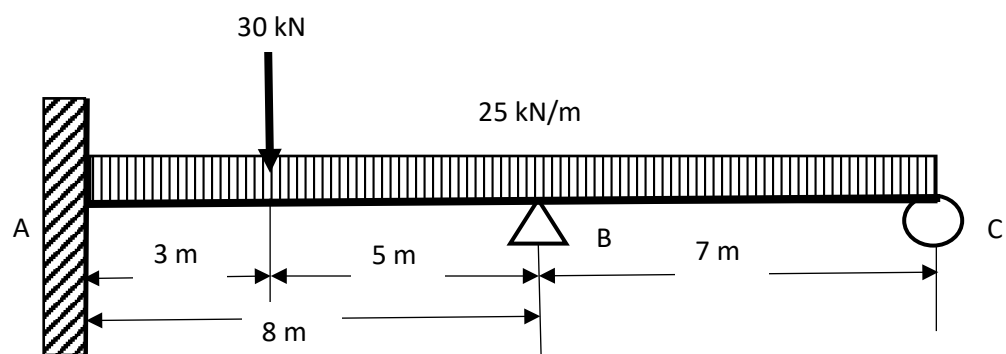

Figure B1 / *Rajah B1*

CLO1
C2

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

Kenalpasti nilai momen hujung terikat pada setiap rentang

[4 marks]

[*4 markah*]

CLO1
C2

(b)   Determine the slope deflection equations for each span

Tentukan persamaan cerun pesongan pada setiap rentang

[6 marks]

[*6 markah*]

CLO1
C3

(c)   i.   Calculate the final moment for each member

Kirakan momen akhir bagi setiap anggota

[7 marks]

[*7 markah*]

ii.   Illustrate the shear force diagram

Lukiskan gambarajah daya ricih

[8 marks]

[*8 markah*]

QUESTION 2
SOALAN 2

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

Rajah B2 menunjukkan sebuah kerangka yang dikenakan beban teragih seragam. Nilai EI adalah malar untuk setiap rentang.
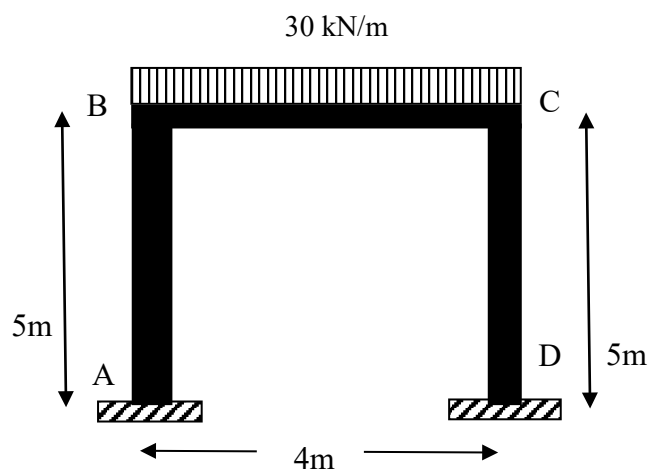
30 kN/m

B   C

5m

A   D   5m

4m

Figure B2 / *Rajah B2*

CLO1 (a)   Calculate the value of Fixed End Moment (FEM) by using Slope and Deflection
C2   Method

             Kirakan Momen Hujung terikat (M^F) dengan menggunakan Kaedah Cerun dan
             Pesongan

                                                                    [4 marks]
                                                                    [4 *markah*]

CLO1 (b)   Identify the moment equation for each support by using Slope and Deflection
C2   Method

             Tentukan persamaan momen pada setiap sokong dengan menggunakan
             Kaedah Cerun Pesongan

                                                                    [6 marks]
                                                                    [6 *markah*]

CLO1
C3

(c)   i.   Calculate the final moment for each span using the Slope Deflection
Method

Kirakan momen akhir pada setiap sambungan dengan menggunakan
Kaedah   Cerun Pesongan.

[7 marks]

[7 *markah*]

ii.   Sketch the shear force diagram (SFD).

Lakarkan gambarajah daya ricih (GDR)

[8 marks]

[8 *markah*]

QUESTION 3

SOALAN 3

A continuous beam is fixed at A, while supported by roller at B and C that carries a uniformly distribution load and point load as shown in **Figure B3.** Use the moment distribution method.

*Satu rasuk selanjar diikat tegar pada A manakala di tupang roda pada titik B dan C dikenakan beban teragih seragan dan beban tumpu seperti **Rajah B3**. Gunakan Kaedah Agihan Momen.*
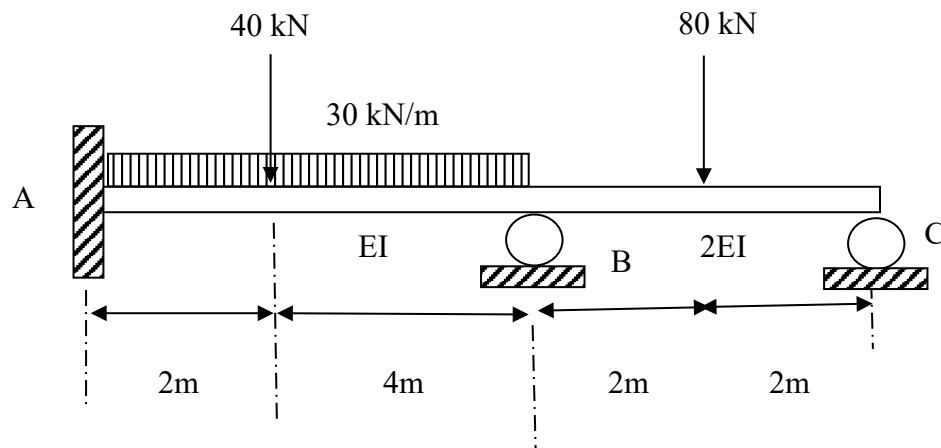

Figure B3 / *Rajah B3*

CLO1
C2

(a)   Determine the fixed end moment

      Tentukan momen hujung terikat

[4 marks]

[4 *markah*]

CLO1
C2

(b)   Identify the distribution and stiffness factors

      Kenalpasti faktor agihan dan kekukuhan

[6 marks]

[6 *markah*]

CLO1
C3

(c)   Build a moment distribution table based on **Figure B3**.

*Binakan jadual agihan momen berdasarkan **Rajah B3**.*

    i.   Calculate the final moment for each member

       Kirakan momen akhir bagi setiap ahli

[7 marks]

[*7 markah*]

    ii.   Sketch Shear Force Diagram

       Lakarkan Gambarajah Daya Ricih

[8 marks]

[*8 markah*]

QUESTION 4

SOALAN 4

A frame is fixed at A and D carries a uniformly distribution load and point load as shown in **Figure B4.**

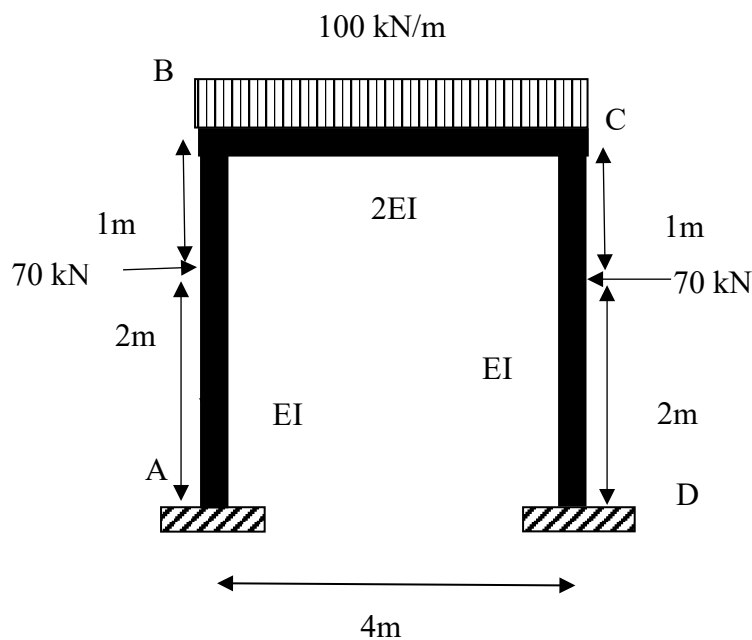*Satu kerangka diikat tegar pada A dan D dikenakan beban teragih seragam dan beban tumpu seperti **Rajah B4.***

Figure B4 / *Rajah B4*

CLO1
C2

(a)   Identify the factors that show frame stability.
       Kenalpasti faktor yang menunjukkan kestabilan kerangka.

[4 marks]
[4 *markah*]

CLO1
C2

(b)   Determine the fixed end moment
       Tentukan momen hujung terikat

[6 marks]
[6 *markah*]

CLO1
C3

(c)   Based on the moment distribution method

Berpandukan kaedah agihan momen

     i.   Calculate the distribution and stiffness factors

           Kirakan faktor agihan dan kekukuhan

[7 marks]

[*7 markah*]

     ii.   Calculate the final moment at supports with 4 times balancing

           Kirakan momen akhir pada sokong dengan 4 kali imbangan

[8 marks]

[*8 markah*]

Notes

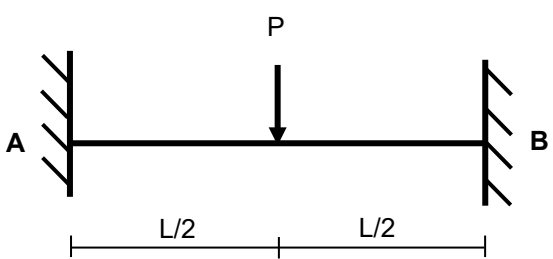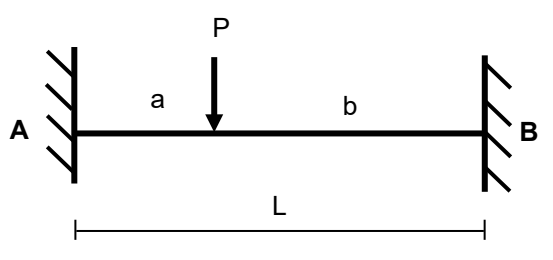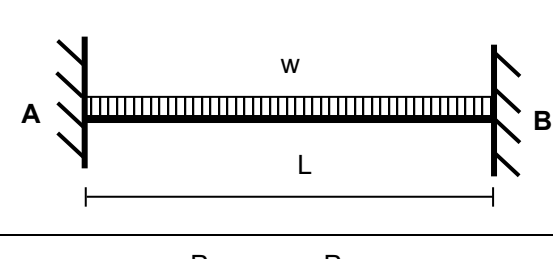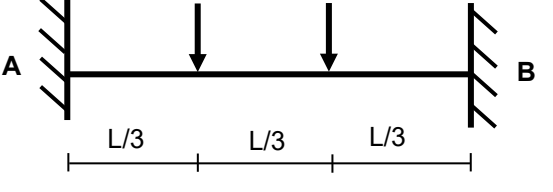Assessment items for this course have covered elements of the Dublin Problem: DP1, DP2 and DP3 as mention in FEIST.

SOALAN TAMAT

1. Slope Deflection Method

$$M_{AB} = \frac{2EI}{L}\left(2\theta_A + \theta_B - \frac{3\Delta}{L}\right) + FEM_{AB}$$

$$M_{BA} = \frac{2EI}{L}\left(2\theta_B + \theta_C - \frac{3\Delta}{L}\right) + FEM_{BA}$$

$FEM_{AB} = -\dfrac{PL}{8}$		$FEM_{BA} = +\dfrac{PL}{8}$
$FEM_{AB} = -\dfrac{Pab^2}{L^2}$		$FEM_{BA} = -\dfrac{Pa^2b}{L^2}$
$FEM_{AB} = -\dfrac{wL^2}{12}$		$FEM_{BA} = +\dfrac{wL^2}{12}$
$FEM_{AB} = -\dfrac{2PL}{9}$		$FEM_{AB} = +\dfrac{2PL}{9}$

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 / $\sum$ K

3. Statically Indeterminate Truss

    i.   Redundant Force

$$R = - \frac{\sum P\mu L / AE}{\sum \mu^2 L / AE}$$

    ii.   Internal Force

$$F = P + \mu R$$

4. Displacement

    i.   external load

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

    ii.   temperature changers

$$\Delta = \sum \mu cLt$$

    iii.   fabrication error

$$\Delta = \sum \mu \lambda$$

5. Influence Lines

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

    ii. $V_C = - x/L, \quad R_A = 1 - x/L$

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