KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR
SESI II : 2023/2024

DCC20053 : MECHANICS OF CIVIL ENGINEERING STRUCTURES

TARIKH   : 06 JUN 2024
MASA   : 2.30 PETANG – 4.30 PETANG (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Bahagian A: Subjektif (2 soalan)
Bahagian B: Subjektif (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)** subjective questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1   (a)   With the aid of a reaction's forces diagram, explain fixed end support.

Dengan bantuan lakaran gambarajah daya tindakbalas, terangkan sokongan hujung terjempit.

[5 marks]

[*5 markah*]

CLO1   (b)   A simply supported beam AE 8m long carries a point load, uniformly distributed load and moment as shown in Figure A1(b). With the aid of free body diagram, calculate the reaction forces (A_x, A_y dan E_y) at each support.

Rasuk AE yang disokong mudah sepanjang 8m, dikenakan beban tumpu, beban teragih seragam dan beban momen seperti yang ditunjukkan dalam Rajah A1(b). Dengan bantuan gambarajah jasad bebas, kirakan daya tindakbalas (A_x, A_y dan E_y) pada setiap sokongan.

10kNm   8kN

15kN/m

A   B   C   D   E

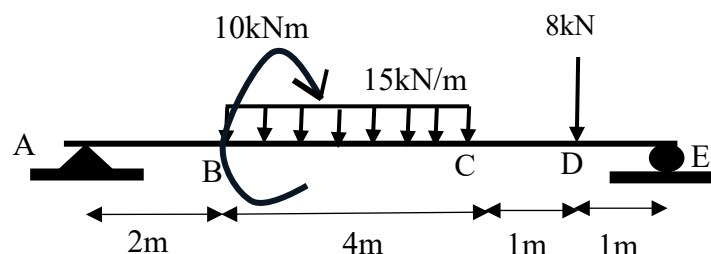2m   4m   1m   1m

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

[10 marks]

[*10 markah*]

CLO1   (c)   A shaft component shown in Figure A1(c) is subjected to a tensile load of 200kN. Determine the total elongation of the shaft if the Modulus of Elasticity is 200GPa.

Komponen aci yang ditunjukkan dalam Rajah A1(c) dikenakan beban tegangan sebanyak 200kN. Tentukan jumlah pemanjangan aci jika Modulus Keanjalan ialah 200GPa.
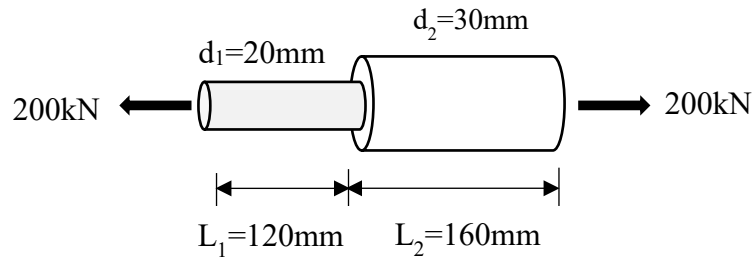

Figure A1(c) / *Rajah A1 (c)*

[10 marks]

[*10 markah*]

QUESTION 2
SOALAN 2

CLO1   (a)   Figure A2(a) shows a T section beam.

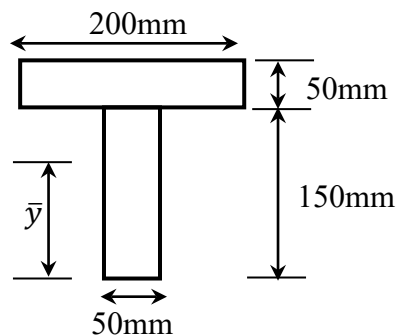*Rajah A2(a) menunjukkan rasuk berkeratan T.*

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

Based on Figure A2(a),

Berdasarkan Rajah A2(a),

(i)   Identify the distance of neutral axis ($\bar{y}$) of a T section of the beam.

Kenal pasti jarak paksi neutral ($\bar{y}$) bagi rasuk berkeratan T.

[5 marks]

[*5 markah*]

(ii)   Calculate the second moment of area for T section beam.

Kirakan moment luas kedua bagi rasuk berkeratan T.

[8 marks]

[*8 markah*]

CLO1   (b)   Two rivets are used to connect three steel plates as shown in Figure A2(b). If the connection can resist 65kN of forces and shear stress in the rivet is 150MN/m^2, determine diameter of the rivets.

Dua rivet digunakan untuk menyambung tiga plat keluli seperti yang ditunjukkan dalam Rajah A2(b). Jika sambungan boleh menahan daya sebanyak 65kN dan tegasan ricih dalam rivet ialah 150MN/m^2, tentukan diameter rivet.
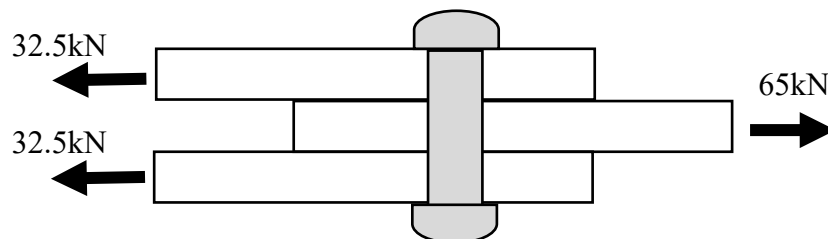
32.5kN

32.5kN

65kN

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

[6 marks]

[*6 markah*]

CLO1   (c)   Figure A2(c) shows a simply supported beam is subjected to point load, uniformly distributed load, and moment. Given A_y = 46kN and B_y =24kN. By using Macaulay's method, construct the equations for bending moment (EId^2y/dx^2), slope $(EIdy/dx)$ and deflection (EIy).

Rajah A2(c) menunjukkan rasuk disokong mudah yang dikenakan beban tumpu, beban teragih seragam dan momen. Diberi A_y =46kN dan B_y =24kN. Dengan menggunakan Kaedah Macaulay, bina persamaan moment lentur (EId^2y/dx^2), persamaan cerun $(EIdy/dx)$ and persamaan pesongan (EIy).
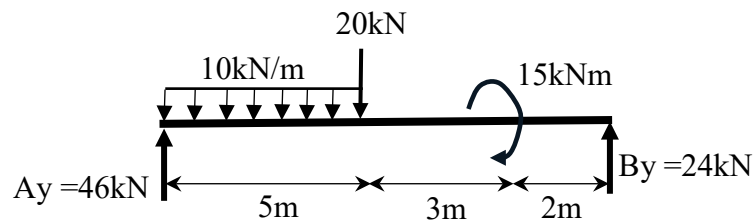

Figure A2(c) / *Rajah A2(c)*

[6 marks]

[*6 markah*]

SECTION B: 50 MARKS

BAHAGIAN B: 50 MARKAH

INSTRUCTION:

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

ARAHAN:

*Bahagian ini mengandungi **FOUR (4)** soalan subjektif. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO2

(a)   A simply supported beam is loaded with uniformly distributed load, point load and moment load as shown in Figure B1(a). Identify the reaction force for each support.

Rasuk disokong mudah dikenakan beban teragih seragam, beban tumpu dan beban moment seperti yang ditunjukkan pada Rajah B1(a). Kenal pasti nilai daya tindakbalas bagi setiap penyokong.
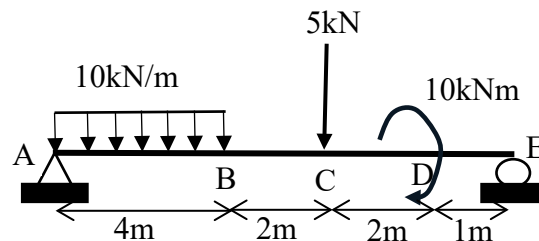

Figure B1(a) / *Rajah B1(a)*

[5 marks]

[*5 markah*]

CLO2

(b)   Using the answer from question 1(a), calculate shear force value and bending moment value at each point.

Berdasarkan jawapan dari soalan 1(a), kirakan nilai daya ricih dan nilai momen lentur pada setiap titik.

[10 marks]

[*10 markah*]

CLO2   (c)   Illustrate shear force diagram (SFD) and bending moment diagram (BMD) of the beam based on the answer from question 1(b) including maximum bending moment value.

Lakarkan gambarajah daya ricih (GDR) dan gambar rajah momen lentur (GML) rasuk berdasarkan jawapan daripada soalan 1(b) termasuk nilai momen lentur maksimum.

[10 marks]

[*10 markah*]

QUESTION 2
SOALAN 2

CLO2   (a)   A cross section of rectangular beam as shown in Figure B2(a), carries a maximum moment 120kNmm, estimate maximum bending stress of the beam.

Keratan rentas rasuk segi empat tepat seperti yang ditunjukkan dalam Rajah B2(a), dikenakan momen maksimum sebanyak 120kNmm, anggarkan tegasan lentur maksimum rasuk.
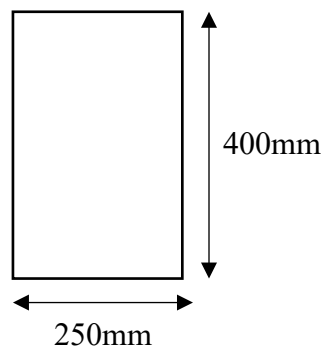
400mm

250mm

Figure B2(a) / *Rajah B2(a)*

[5 marks]

[*5 markah*]

CLO2

(b)   A symmetrical I-section beam as shown in Figure B2(b) carries a uniformly distributed load of 20kN/m along the span. Calculate the maximum moment (M_{max}) and second moment of area (I_{xx}) for the beam.

Rasuk simetri berkeratan I seperti yang ditunjukkan dalam Rajah B2(b) dikenakan beban teragih seragam sebanyak 20kN/m di sepanjang rentang. Kirakan momen maksimum (M_{mak}) dan momen luas kedua (I_{xx}) bagi rasuk.
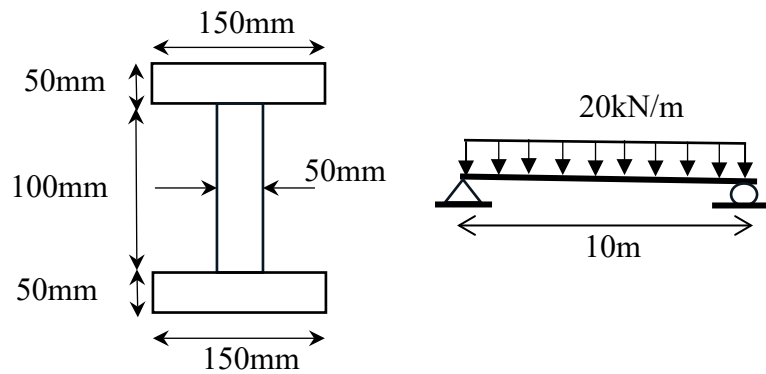

Figure B2(b) / *Rajah B2(b)*

[10 marks]

[*10 markah*]

CLO2

(c)   Illustrate and label the maximum bending stress distribution diagram for symmetrical I section, based on the answer from question 2(b).

Lakarkan dan labelkan gambarajah taburan tegasan lentur maksimum bagi rasuk simetri berkeratan I, berdasarkan jawapan dari soalan 2(b).

[10 marks]

[*10 markah*]

QUESTION 3
SOALAN 3

CLO2

(a)   Figure B3(a) shows a cross section of a rectangular beam carrying a shear force of 100kN. Estimate the maximum shear stress (τ) in the beam using the given formula.

Rajah B3(a) menunjukkan keratan rentas rasuk segiempat tepat yang dikenakan daya ricih 100kN. Anggarkan tegasan ricih maksimum (τ) dalam rasuk menggunakan formula yang diberikan.
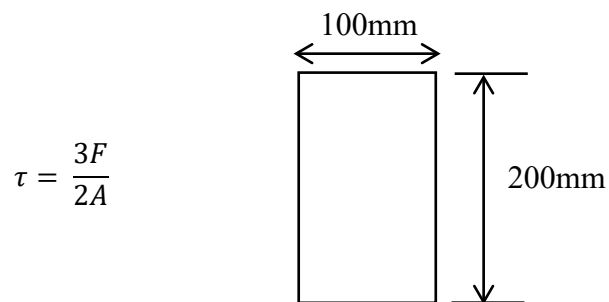
$$\tau = \frac{3F}{2A}$$

100mm

200mm

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

[5 marks]

[*5 markah*]

CLO2   (b)   A symmetrical I section beam as shown in figure B3(b) loaded with maximum shear force of 85kN. Calculate second moment of area (I_{xx}) and shear stress (τ) at neutral axis.

Rasuk simetri berkeratan I seperti yang ditunjukkan dalam Rajah B3(b) dikenakan dengan daya ricih maksimum sebanyak 85kN. Kirakan momen luas kedua (I_{xx}) dan tegasan ricih (τ) pada paksi neutral.
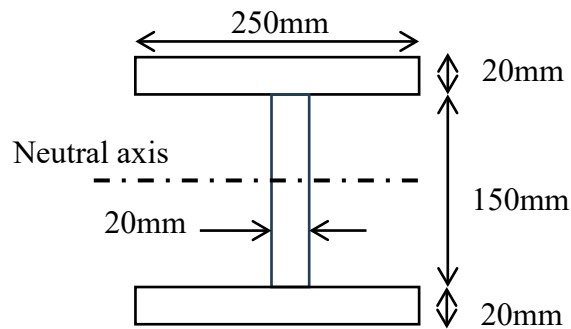

Figure B3(b) / *Rajah B3(b)*

[10 marks]

[*10 markah*]

CLO2   (c)   T section beam as shown in Figure B3(c) is subjected to a shear force of 100kN. Calculate second moment of area (I_{xx}), shear stress at flange and web including maximum shear stress value.

Satu rasuk berkeratan T seperti yang ditunjukkan dalam Rajah B3(c) dikenakan daya ricih sebanyak 100kN. Kirakan moment luas kedua (I_{xx}), tegasan ricih pada bebibir dan web rasuk termasuk nilai tegasan ricih maksimum.
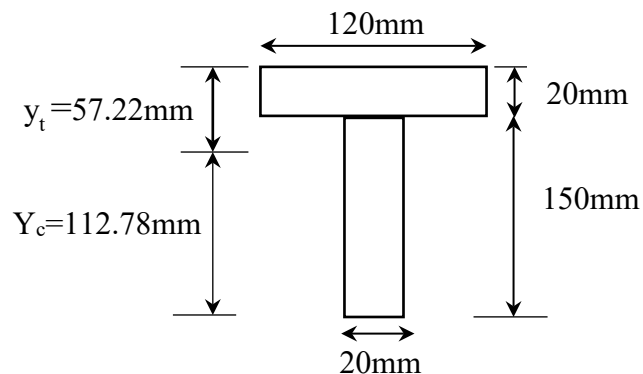

Figure B3(c) / *Rajah B3(c)*

[10 marks]

[*10 markah*]

QUESTION 4
SOALAN 4

CLO2

(a) A simply supported beam is subjected to a point load of 15kN and a uniformly distributed load 25kN/m along the span as shown in Figure B4(a). Using Macaulay's method, show the moment equation (EId^2y/dx^2) and slope equation ($EIdy/dx$) when the beam cut at x-x.

Rasuk di sokong mudah dikenakan beban tumpu 15kN dan beban teragih seragam 25kN/m di sepanjang rentang seperti yang ditunjukkan dalam Rajah B4(a). Dengan menggunakan kaedah Macaulay, tunjukkan persamaan moment (EId^2y/dx^2) dan persamaan cerun ($EIdy/dx$) apabila rasuk dikerat pada x-x.
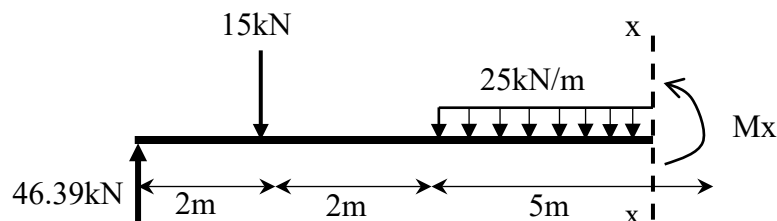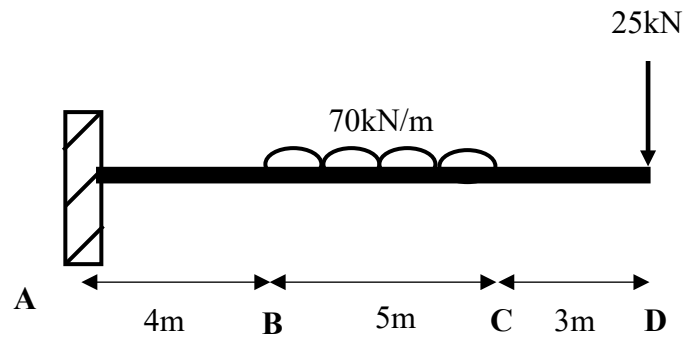

Figure B4(a) / *Rajah B4(a)*

[5 marks]
[*5 markah*]

CLO2

(b) A cantilever beam is subjected to a point and uniformly distributed load as shown in Figure B4(b). Given the reaction at point is A_y = 375kN and M_A = 2575kNm. By using the moment area method, calculate moment value for each load applied to the beam in moment area diagram.

Satu rasuk julur dikenakan beban titik dan beban teragih seragam seperti yang ditunjukkan dalam Rajah B4(b). Diberi tindakbalas di titik A_y = 375kN and M_A = 2575kNm. Dengan menggunakan kaedah momen luas, kirakan nilai momen bagi setiap beban yang dikenakan pada rasuk dalam rajah momen luas.

25kN

70kN/m

A

4m   B   5m   C   3m   D

Figure B4(b) / *Rajah B4(b)*

[10 marks]

[*10 markah*]

CLO2   (c)   Using the answer from question 4(b), analyze slope and deflection at free end.

Berdasarkan jawapan dari soalan 4(b), analisis cerun dan pesongan pada hujung bebas.

[10 marks]

[*10 markah*]

SOALAN TAMAT

LIST OF FORMULA FOR DCC20053 MECHANICS OF CIVIL ENGINEERING STRUCTURES

1. $\sigma = \dfrac{P}{A}$	5. $Z = \dfrac{I}{\bar{y}}$
2. $\varepsilon = \dfrac{\delta L}{L}$	6. $\sigma = \dfrac{M}{I} \times \bar{y}$
3. $E = \dfrac{\sigma}{\varepsilon} @ E = \dfrac{PL}{A\delta L}$	7. $\tau = \dfrac{F}{nA} \ \& \ \tau = \dfrac{F}{2\ x\ n\ x\ A}$
4. $I_{xx} = \dfrac{bd^3}{12} + Ad^2$	8. $\tau = \dfrac{VAy}{I_x b}$

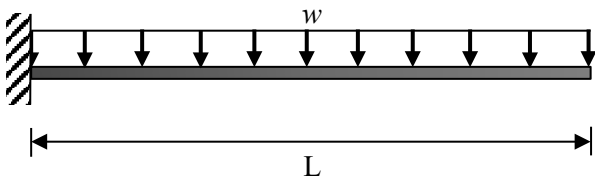## TABLE 1 MAXIMUM MOMENT FORMULA FOR SPECIFIC BEAM AND LOAD
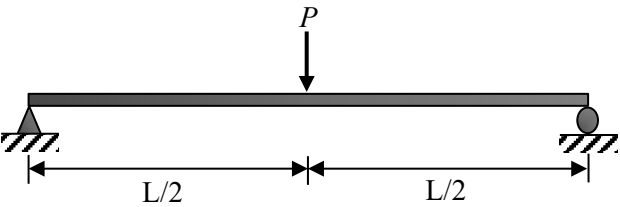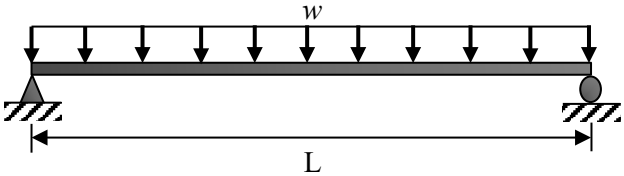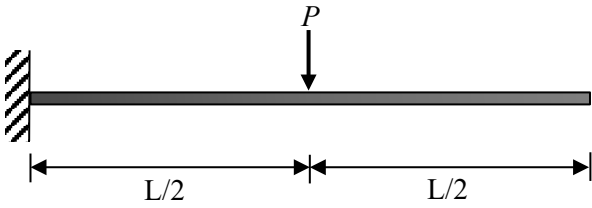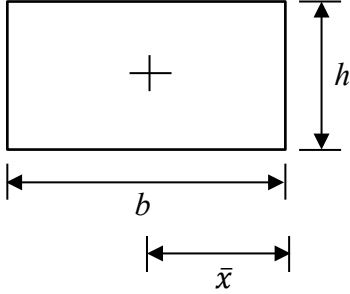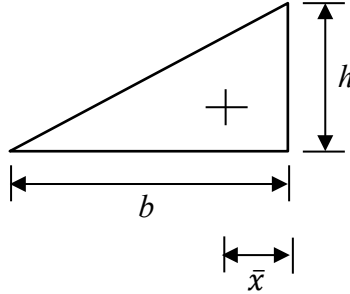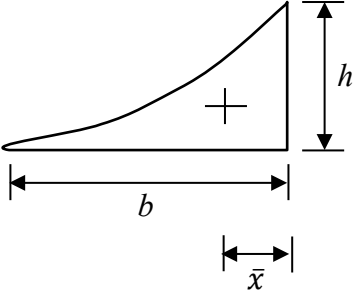
Beam with specific load	Maximum moment
	$\dfrac{PL}{4}$
	$\dfrac{wL^2}{8}$
	$\dfrac{-PL}{2}$
	$\dfrac{-wL^2}{2}$

TABLE 2 GEOMETRIC PROPERTIES OF AREA

Shape	Area, A	Centroid, $\bar{x}$
	bh	$\dfrac{1}{2}b$
	$\dfrac{1}{2}bh$	$\dfrac{1}{3}b$
	$\dfrac{1}{3}bh$	$\dfrac{1}{4}b$