SULIT

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 I : 2024/2025

DCC20053 : MECHANICS OF CIVIL ENGINEERING STRUCTURES

TARIKH : 26 NOVEMBER 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) Structure is a combination of members connected together to serve a useful purpose. Identify **FIVE (5)** types of structure in Civil Engineering.

*Struktur adalah gabungan ahli yang dihubungkan bersama untuk menghasilkan tujuan yang berguna. Kenal pasti **LIMA (5)** jenis struktur dalam Kejuruteraan Awam.*

[5 marks]

[*5 markah*]

CLO1 (b) Explain **FOUR (4)** types of beams with the aid of diagrams.

*Terangkan **EMPAT (4)** jenis rasuk dengan bantuan gambar rajah*

[10 marks]

[*10 markah*]

CLO1

(c) A concrete block as shown in Figure A1(c) carrying a compressive load of 120kN. The block is shortened by 0.03mm. Given the diameter of concrete block is 20mm. Calculate the value of direct stress, strain and modulus of elasticity of the concrete block.

Satu blok konkrit seperti ditunjukkan dalam Rajah A1(c) menanggung beban mampatan sebanyak 120kN. Blok tersebut mengalami pemendekan sebanyak 0.03mm. Diameter blok konkrit ialah 20mm. Kirakan nilai tegasan terus, terikan dan modulus keanjalan blok konkrit.

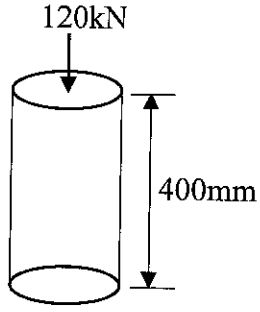


Figure A1(c) / *Rajah A1(c)*

[10 marks]

[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) i. There are two important engineering terms in bending stress beam which are centroid and second moment of area. Explain the meaning of centroid and second moment of area with formula and its units.

Terdapat dua istilah penting kejuruteraan dalam tegasan lentur rasuk iaitu sentroid dan momen luas kedua. Terangkan maksud sentroid dan momen luas kedua beserta dengan formula dan unit.

[5 marks]

[*5 markah*]

CLO1 ii. Figure A2(a)ii shows an L-section of beam. Calculate the centroid of the section at x-axis.

Rajah A2(a)ii menunjukkan sebuah rasuk berkeratan L. Kira sentroid keratan tersebut pada paksi-x.

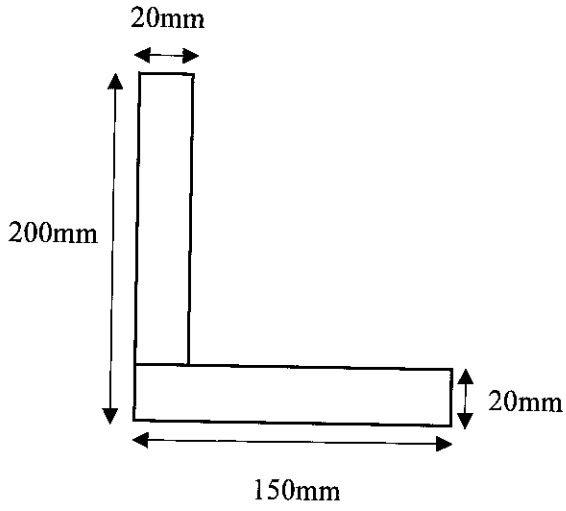


Figure A2(a)ii/ *Rajah A2(a)ii*

[8 marks]

[*8 markah*]

CLO1 (b) Three steel plates as shown in Figure A2(b) are connected by a bolt of 16mm diameter. Determine the shear stress in bolt.

Tiga kepingan keluli seperti ditunjukkan dalam Rajah A2(b) disambungkan dengan menggunakan bolt berdiameter 16mm. Tentukan tegasan ricih di dalam bolt tersebut.

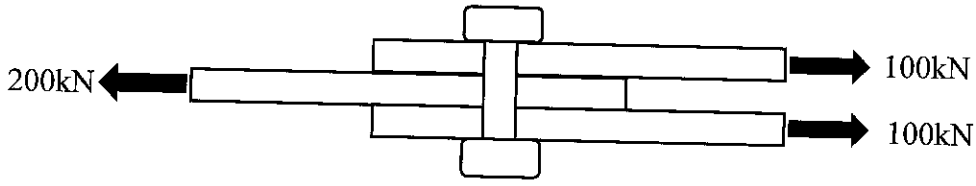


Figure A2(b) / *Rajah A2(b)*

[6 marks]

[*6 markah*]

CLO1 (c) A uniformly distributed load and a point load are imposed on a cantilever beam as shown in Figure A2(c). By using moment area method, illustrate the moment area diagram for the loaded beam. Given A_y = 80kN and M_A = -300kNm.

Beban teragih seragam dan beban tumpu dikenakan ke atas rasuk julur yang ditunjukkan dalam Rajah A2(c). Dengan menggunakan kaedah momen luas, lakarkan gambarajah momen luas bagi rasuk tersebut. Diberikan A_y = 80kN dan M_A = -300kNm.

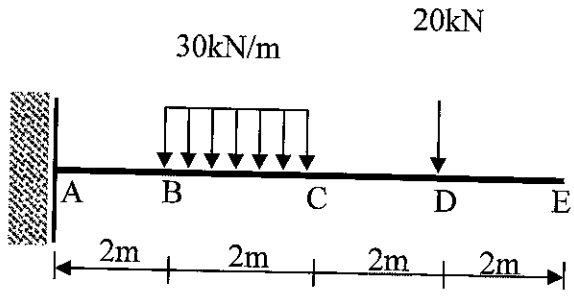


Figure A2(c)/ *Rajah A2(c)*

[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 **EMPAT (4)** soalan subjektif. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1

SOALAN 1

Based on simply supported beam in Figure B1:

Berdasarkan rasuk tupang mudah pada Rajah B1:

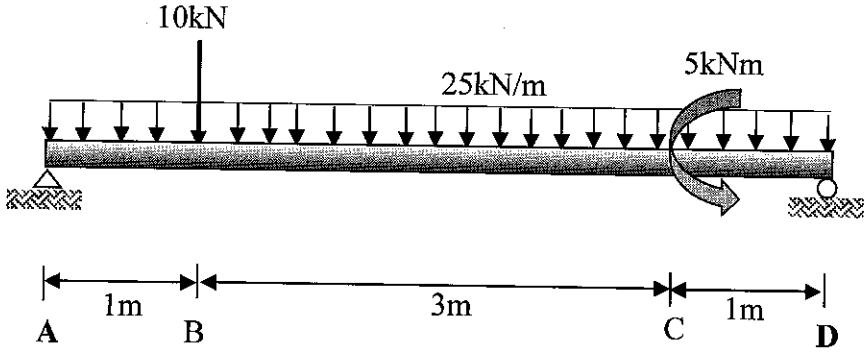


Figure B1/ *Rajah B1*

CLO2 (a) Identify all reactions of the beam.

Kenal pasti semua nilai tindakbalas pada rasuk.

[5 marks]

[*5 markah*]

CLO2 (b) Illustrate shear force diagram (SFD) completed with relevant important values.

Lakarkan gambarajah daya ricih (GDR) dilengkapi dengan nilai-nilai penting yang berkaitan

[10 marks]

[*10 markah*]

CLO2 (c) Illustrate bending moment diagram (BMD) completed with relevant important values.

Lakarkan gambarajah momen lentur (GML) dilengkapi dengan nilai-nilai penting yang berkaitan.

[10 marks]

[*10 markah*]

QUESTION 2

SOALAN 2

A symmetrical I-section beam as shown in Figure B2 is subjected to a load of 60kN and carries a uniformly distributed load of 15kN/m along the whole span.

Satu rasuk berkeratan I- semetri seperti dalam Rajah B2 menanggung beban 60kN dan dikenakan beban teragih seragam 15kN/m di sepanjang rasuk.

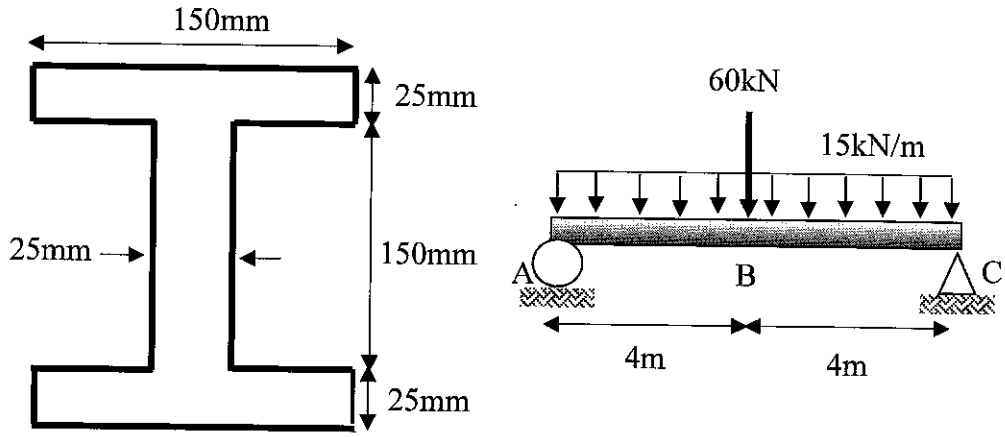


Figure B2/ *Rajah B2*

CLO2 (a) Identify the position of neutral axis for the cross-section beam.

Kenal pasti kedudukan paksi neutral terhadap keratan rentas rasuk.

[5 marks]

[*5 markah*]

CLO2 (b) Calculate the value of second moment of area for the beam cross section.

Kirakan nilai momen luas kedua terhadap keratan rentas rasuk tersebut.

[10 marks]

[*10 markah*]

CLO2 (c) Illustrate the bending stress distribution diagram with the value of maximum bending stress for beam cross section (compression and tension)
Lakarkan gambarajah taburan tegasan lentur dengan nilai tegasan lentur maksimum pada rasuk (mampatan dan tegangan).

[10 marks]
[*10 markah*]

QUESTION 3
SOALAN 3

CLO2 (a) Three steel plates as shown in Figure B3(a) are connected together by three bolts of 12mm diameter. Identify the value of shear stress.
Tiga keping plat keluli seperti ditunjukkan dalam Rajah B3(a) disambungkan bersama menggunakan tiga bolt berdiameter 12mm. Kenal pasti nilai tegasan ricih.

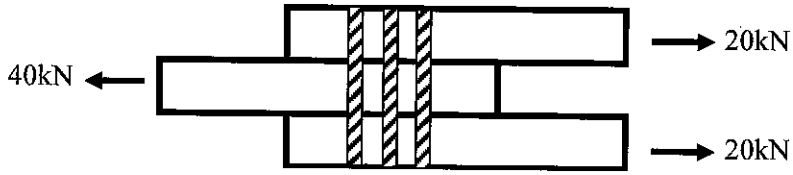


Figure B3(a) / *Rajah B3(a)*

[5 marks]
[*5 markah*]

CLO2 (b) A rectangular section beam as shown in Figure B3(b) is subjected to a shear force of 20kN. Calculate shear stress at 25mm distance from top to neutral axis section.

Satu rasuk berkeratan segi empat tepat seperti dalam Rajah B3(b) telah dikenakan daya ricih sebanyak 20kN. Kirakan tegasan ricih pada jarak 25mm dari atas hingga ke paksi neutral keratan.

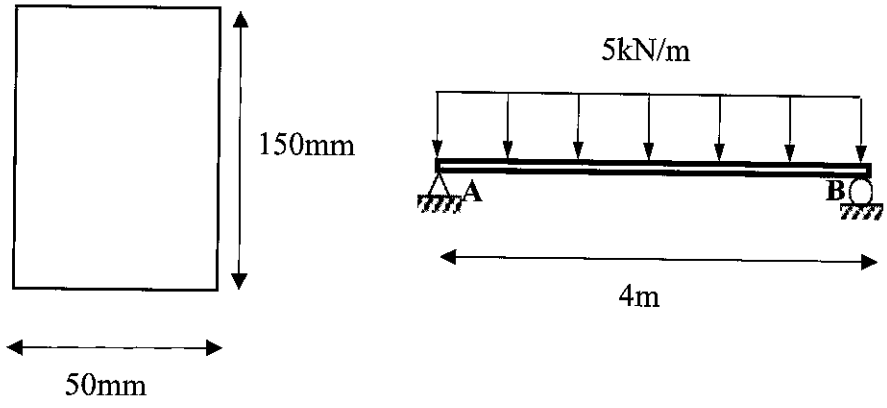


Figure B3 (b) / *Rajah B3(b)*

[10 marks]

[*10 markah*]

CLO2

(c) A T section beam as shown in Figure B3(c) is subjected to a shear force of 50kN. Given centroid, $\bar{y}$ = 67.78mm and second moment of area Ixx = 3.137x10^{6}mm^4. Calculate the value of shear stress at neutral axis, flange and junction of the web includes with shear stress distribution diagram.

Satu rasuk berkeratan T seperti dalam Rajah B3(c) telah dikenakan daya ricih sebanyak 50kN. Diberikan nilai kedudukan sentroid $\bar{y}$ = 67.78mm dan momen luas kedua Ixx = 3.137x10^{6}mm^4. Kirakan tegasan ricih pada paksi neutral, bebibir dan persimpangan web beserta dengan gambarajah taburan tegasan ricih.

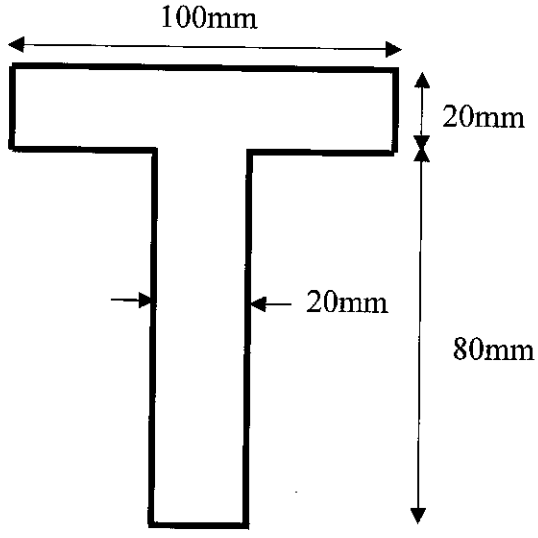


Figure B3(c) / *RajahB3(c)*

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

Based on Figure B4:

Berdasarkan Rajah B4:

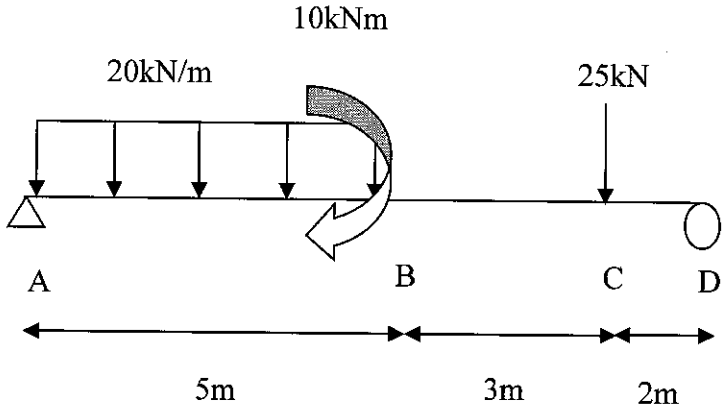


Figure B4 / *Rajah B4*

CLO2 (a) By using Macaulay's method, show the moment equation for simply supported beam as shown in Figure B4.

Dengan menggunakan kaedah Macaulay, tunjukkan persamaan momen lentur untuk rasuk disokong mudah seperti yang ditunjukkan dalam Rajah B4.

[5 marks]

[*5 markah*]

CLO2 (b) Determine the slope and deflection equation completed with values of C_1 and C_2 by using Macaulay's method.

Tentukan persamaan kecerunan dan persamaan pesongan yang dilengkapi dengan nilai-nilai C_1 dan C_2 dengan menggunakan kaedah Macaulay.

[10 marks]

[*10 markah*]

CLO2

(c) Calculate slope and deflection at point B by using Macaulay's method. Given E = 210GPa and I = 125 x $10^6 mm^4$.

Kirakan kecerunan dan pesongan pada titik B dengan menggunakan kaedah Macaulay. Diberi, E = 210GPa dan I = 125 x $10^6 mm^4$.

[10 marks]

[*10 markah*]

SOALAN TAMAT

LIST OF FORMULA FOR DCC20053 MECHANICS OF CIVIL ENGINEERING STRUCTURES

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

TABLE 1 MAXIMUM MOMENT FORMULA FOR SPECIFIC BEAM AND LOAD

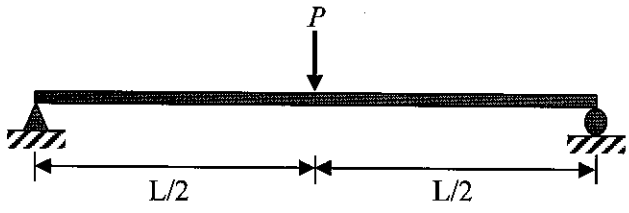
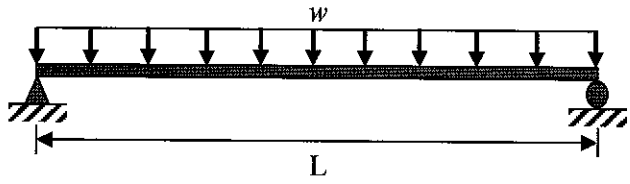
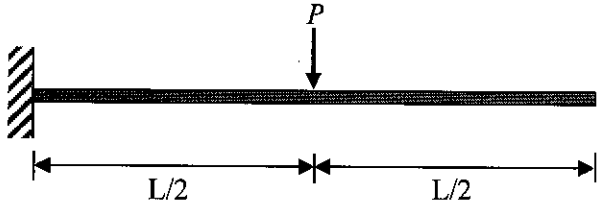
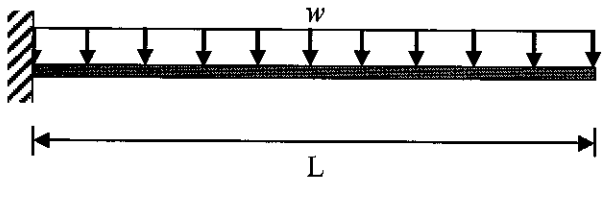
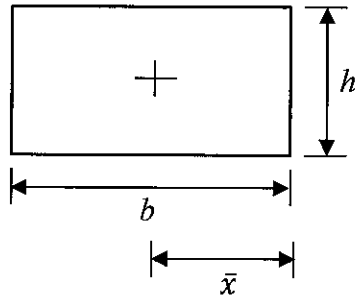
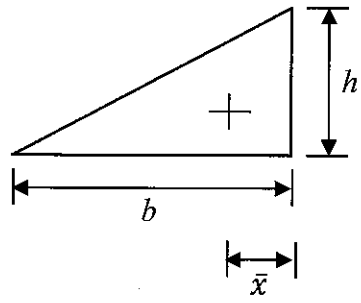
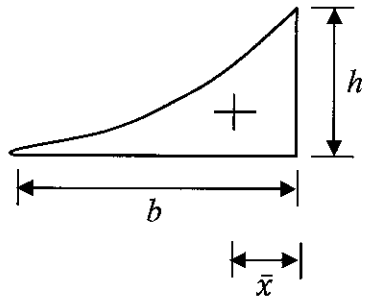
Beam with specific load	Maximum moment
	$\frac{PL}{4}$
	$\frac{wL^2}{8}$
	$\frac{-PL}{2}$
	$\frac{-wL^2}{2}$

TABLE 2 GEOMETRIC PROPERTIES OF AREA

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