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 : 2023/2024

DCC20053: MECHANICS OF CIVIL ENGINEERING STRUCTURES

TARIKH : 03 JANUARI 2024
MASA : 08.30 AM - 10.30 AM (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (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) Explain the meaning of structure and mechanic of structures in Civil Engineering.
Terangkan maksud struktur dan mekanik struktur dalam Kejuruteraan Awam.

[5 marks]
[*5 markah*]

CLO1 (b) Explain **THREE (3)** types of load with the aid of diagram.
*Terangkan **TIGA (3)** jenis beban dengan bantuan gambar rajah.*

[10 marks]
[*10 markah*]

CLO1 (c) A rod has 3.5 mm of diameter with 2.5 m of length. If this bar is imposed by 142 kN and elongation occur is 0.5 mm. Calculate modulus of elasticity in the rod, E.
Satu rod mempunyai diameter 3.5 mm dengan panjang 2.5 m. Sekiranya bar tersebut dikenakan daya sebanyak 142 kN dan mengalami pemanjangan 0.5 mm. Kirakan modulus keanjalan di dalam rod, E.

[10 marks]
[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) i. Bending stress is zero at the beam's neutral axis, which is coincident with the centroid of the beam's cross section. In order to calculate stress caused by bending, we need to understand where the neutral axis of the beam is, and how to calculate the second moment of area for a given cross section. Explain the meaning of second moment of area accordingly.

Tegasan lentur adalah sifar pada paksi neutral rasuk, yang bertepatan dengan pusat keratan rentas rasuk. Untuk mengira tegasan yang disebabkan oleh lenturan, kita perlu memahami di mana paksi neutral rasuk itu, dan cara mengira momen luas kedua untuk keratan rentas tertentu. Terangkan maksud momen luas kedua dengan sewajarnya.

[5 marks]

[*5 markah*]

CLO1 ii. Figure A2(a) shows a T-section beam. Calculate the centroid of the section at y-axis and x-axis.

Rajah A2(a) menunjukkan satu rasuk keratan T. Kirakan sentroid keratan pada paksi-y dan paksi-x.

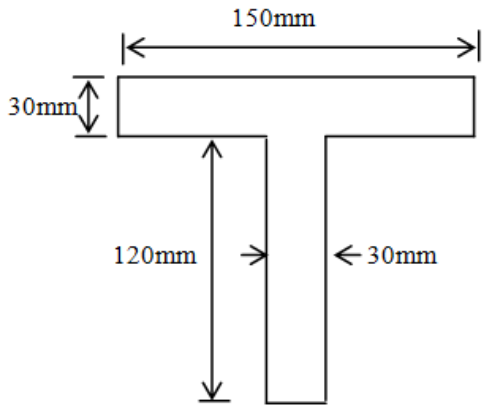


Figure A2(a) / *Rajah A2(a)*

[8 marks]

[*8 markah*]

CLO1 (b) Two pieces of iron plate were fasten the wooden board by using bolts of 20 mm diameter as shown in Figure A2(b). Wooden board was then pulled by a shear force of 120 kN. Determine the shear stress that occur in each bolt.

Dua keping plat besi mengikat papan kayu dengan menggunakan bolt berdiameter 20 mm seperti yang ditunjukkan dalam Rajah A2(b). Papan kayu kemudiannya ditarik dengan daya ricih 120 kN. Tentukan tegasan ricih yang berlaku dalam setiap bolt.

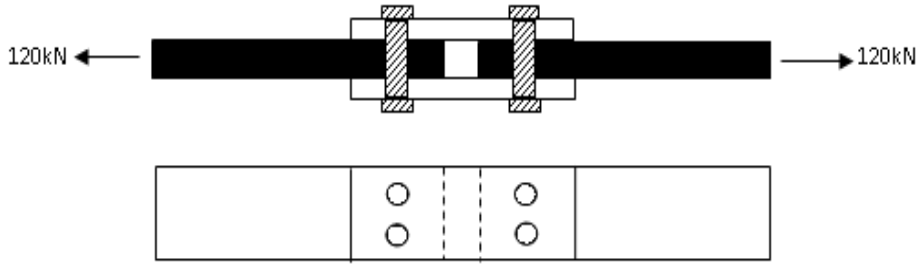


Figure A2(b) / *Rajah A2(b)*

[6 marks]

[*6 markah*]

CLO1 (c) By using moment area method and with the help of bending moment diagram for each load, calculate the value of bending moment for the beam in Figure A2(c**)**. Given the reaction force, Ay = 40 kN.

Dengan menggunakan kaedah momen luas dan bantuan gambar rajah momen lentur bagi setiap beban, kira nilai-nilai momen lentur untuk rasuk dalam Rajah A2(c). Diberi nilai daya, Ay = 40 kN.

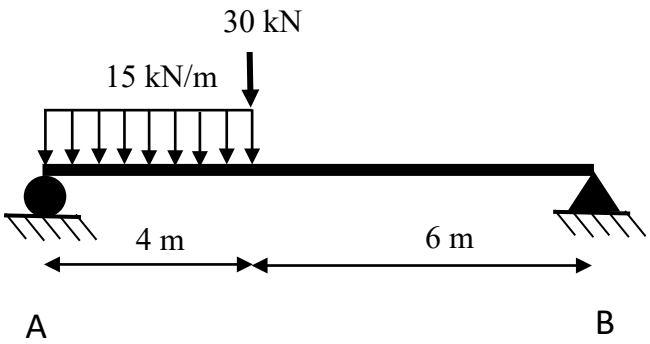


Figure A2(c) / *Rajah A2(c)*

[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

CLO2 (a) Identify **THREE (3)** shapes of shear force diagram (SFD) and bending moment diagram (BMD) for all types of loads**.**

*Kenal pasti bentuk **TIGA (3)** gambarajah daya ricih (GDR) dan gambarajah momen lentur (GML) bagi kesemua jenis beban**.***

[5 marks]

[*5 markah*]

CLO2 (b) Figure B1 (b) shows a simply supported beam is subjected to the loads. Calculate the reactions at support A and D.

Rajah B1 (b) menunjukkan sebuah rasuk ditupang mudah yang dibebani dengan beban-beban seperti yang ditunjukkan di bawah. Kirakan daya-daya tindak balas pada penyokong A dan D.

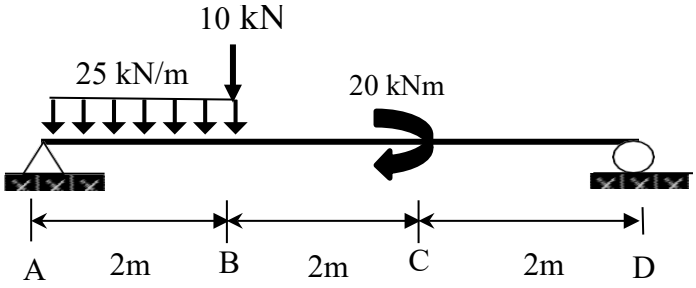


Figure B1 (b) / *Rajah B1 (b)*

[10 marks]

[*10 markah*]

CLO2 (c) Calculate the shear force and bending moment value with shear force diagram (SFD) and bending moment diagram (BMD) for Figure B1 (b).
Kirakan nilai daya ricih dan momen lentur berserta dengan gambarajah daya ricih (GDR) dan gambarajah momen lentur (GML) bagi Rajah B1 (b).

[10 marks]
[*10 markah*]

QUESTION 2
SOALAN 2

A simply supported beam with an unsymmetrical I- section as shown in Figure B2 is subjected to a uniformly distributed load 17 N/mm.
Sebuah rasuk ditupang mudah dengan keratan I tidak simetri seperti yang ditunjukkan dalam Rajah B2 dikenakan dengan beban teragih seragam 17 N/mm.

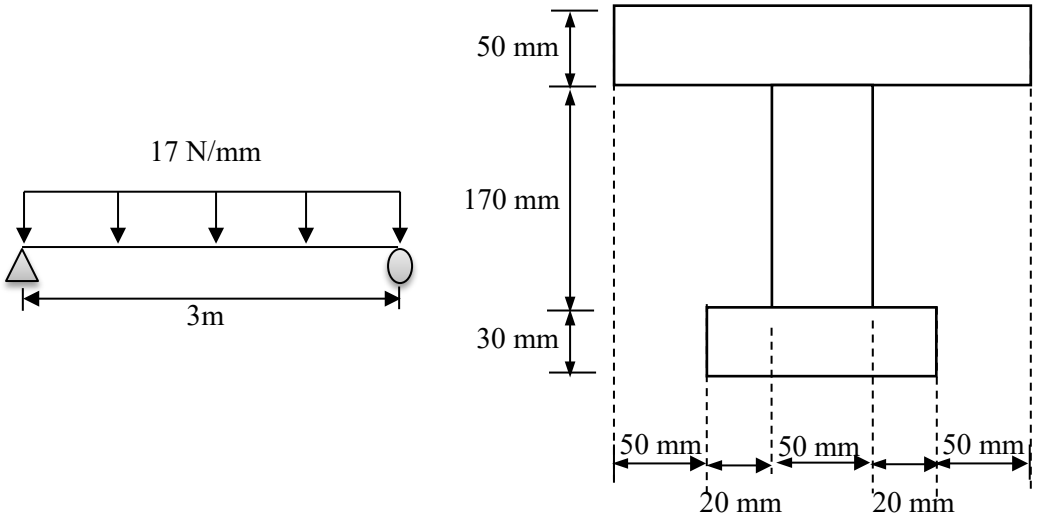


Figure B2 / *Rajah B2*

CLO2 (a) Identify the center of gravity (compression and tensile) for beam.
Kenal pasti pusat graviti (mampatan dan tegangan) untuk rasuk.

[5 marks]
[*5 markah*]

CLO2 (b) Calculate the second moment area of an unsymmetrical I-section.
Kirakan luas momen kedua bagi keratan I tak simetri.

[10 marks]
[*10 markah*]

CLO2 (c) Illustrate the distribution of bending stress diagram across the section with the value of maximum bending stress (compression and tensile).
Gambarkan taburan gambar rajah tegasan lentur merentasi bahagian dengan nilai tegasan lentur maksimum (mampatan dan tegangan).

[10 marks]
[*10 markah*]

QUESTION 3
SOALAN 3

CLO2 (a) Explain single and double shear stress with formula.
Terangkan tegasan ricih tunggal dan tegasan ricih berganda dengan formula.

[5 marks]
[*5 markah*]

CLO2 (b) Calculate the shear stress at 45 mm distance from neutral axis at rectangular beam in Figure B3(b) below. Given shear force is 50 kN.
Kirakan tegasan ricih pada jarak 45 mm dari paksi neutral pada rasuk segi empat tepat dalam Rajah B3(b) di bawah. Daya ricih diberi ialah 50 kN.

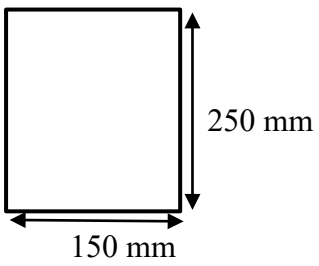


Figure B3(b) / *Rajah B3(b)*

[10 marks]
[*10 markah*]

CLO2

(c) A simply supported beam as shown in Figure B3(c) is subjected to a shear force of 70 kN. If the second moment of area of the section is 23.87 x 10^6 mm^4, calculate the shear stress distribution for the beam section.

Rasuk disokong mudah seperti Rajah B3(c) dikenakan daya ricih sebanyak 70 kN. Jika momen luas kedua keratan ialah 23.87 x 10^6 mm^4, kirakan agihan tegasan ricih pada keratan rasuk tersebut.

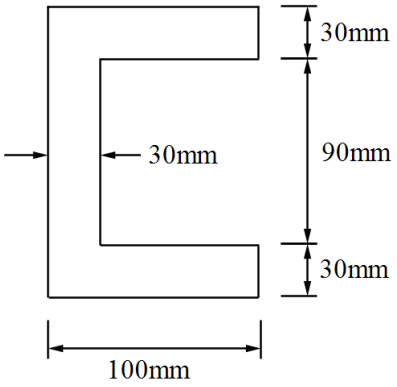


Figure B3(c) / *Rajah B3(c)*

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO2

(a) Show bending moment equation for beam shown in Figure B4(a) below by using the Macaulay's Method.

Tunjukkan persamaan momen lentur untuk rasuk yang ditunjukkan dalam Rajah B4(a) di bawah dengan menggunakan Kaedah Macaulay.

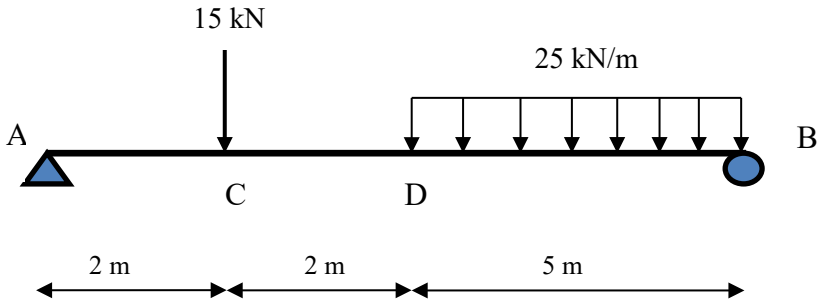


Figure B4(a) / *Rajah B4(a)*

[5 marks]

[*5 markah*]

CLO2 (b) A simply supported beam is loaded as shown in Figure B4(b). If a reaction given at point A is 51 kN and at point B is 24 kN, calculate slope equation and deflection equation by using Macaulay Method.

Rasuk disokong mudah dibebani seperti dalam Rajah B4(b). Jika tindak balas diberikan pada titik A ialah 51 kN dan pada titik B ialah 24 kN, kirakan persamaan cerun dan persamaan pesongan dengan menggunakan Kaedah Macaulay.

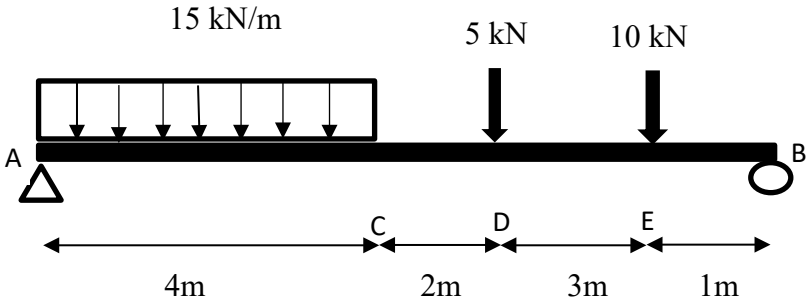


Figure B4(b) / *Rajah B4(b)*

[10 marks]

[*10 markah*]

CLO2 (c) A cantilever beam is shown in Figure B4(c) below. By using Moment Area Method, calculate the deflection at point E in terms of EI.

Rasuk julur ditunjukkan dalam Rajah B4(c) di bawah. Dengan menggunakan Kaedah Momen Luas, kirakan pesongan pada titik E dalam sebutan EI.

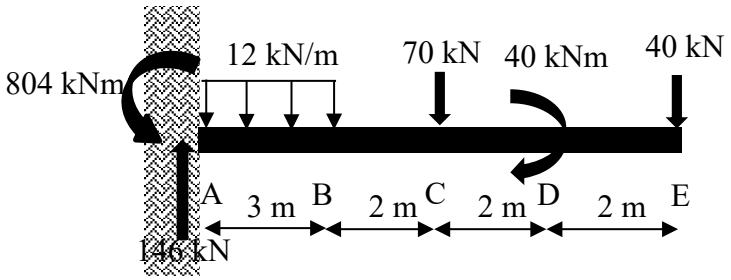


Figure B4 (c) / *Rajah B4(c)*

[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

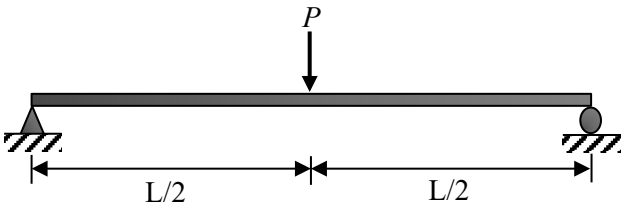
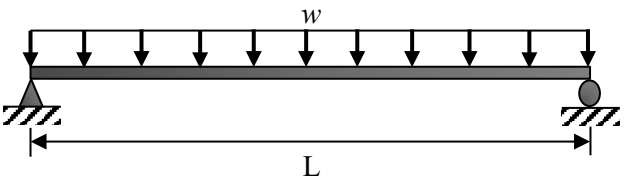
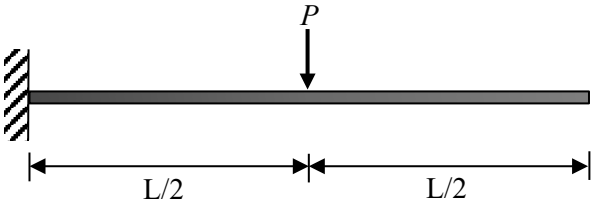
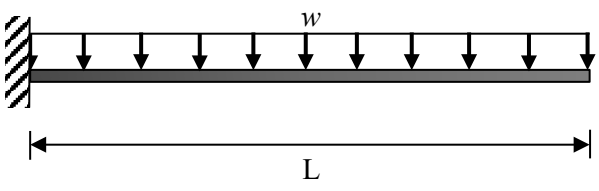
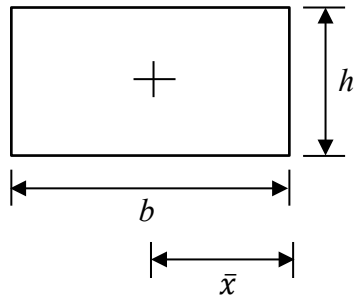
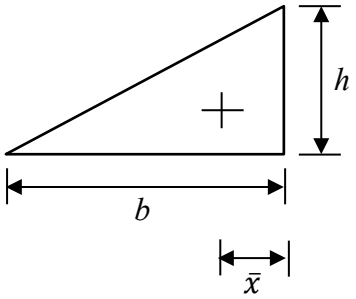
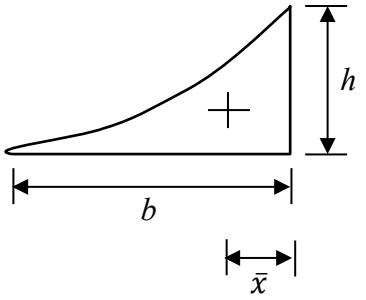
Beam with specific load	Maximum moment
	$\frac{PL}{4}$
	$\frac{wL^2}{8}$
	$\frac{-PL}{2}$
	$\frac{-wL^2}{2}$

TABLE 2 GEOMETRIC PROPERTIES OF AREA

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