

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR**

**SESI DISEMBER 2016**

**DCC2063 : MECHANICS OF CIVIL ENGINEERING STRUCTURES**

**TARIKH : 08 APRIL 2017**

**TEMPOH : 2.30 PM– 4.30 PM ( 2 JAM )**

---

Kertas ini mengandungi **EMPAT BELAS (14)** 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**

- CLO1  
C1
- (a) Define the followings and state the units:  
*Berikan definisi berikut dengan menyatakan unit:*
- i. Direct Stress. [2.5 marks]  
*Tegasan terus.* [2.5 markah]
  - ii. Strain. [2.5 marks]  
*Keterikan.* [2.5 markah]
- CLO1  
C2
- (b) A hollow tube 500mm long has an external and internal dimension of 25mm and 15mm respectively. It is subjected to a tensile force of 50kN and was elongated to 0.25mm. Determine:  
*Satu tiub berongga 500mm panjang mempunyai ukuran luar dan dalam 25mm dan 15mm masing-masing. Ia dikenakan dengan beban tegangan 50kN dan didapati memanjang sebanyak 0.25mm. Tentukan:*
- i. tensile stress. [4 marks]  
*tegasan tegangan.* [4 markah]
  - ii. strain. [2 marks]  
*terikan.* [2 markah]
  - iii. Modulus of elasticity. [2 marks]  
*Modulus keanjalan.* [2 markah]

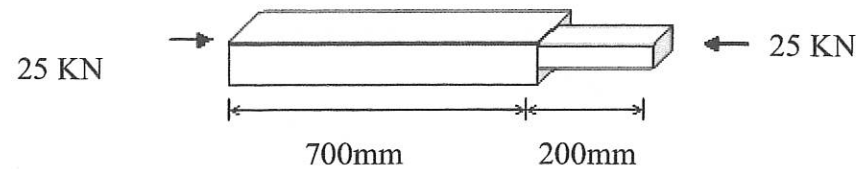
CLO1  
C2

- (c) A steel bar is rigidly fixed to an aluminium bar with their length of 700mm and 200mm respectively as shown in **Figure A1(c)**. Cross-sectional area of steel is  $230\text{mm}^2$  while aluminium is  $150\text{mm}^2$ . Determine the total shortening of the compound bar when subjected to a compressive load of 25kN.

[Given:  $E_s = 207\text{ GPa}$  and  $E_a = 70\text{GPa}$ ]

Satu bar keluli dilekatkan pada bar aluminium dengan panjang masing-masing 700mm dan 200mm seperti yang ditunjukkan dalam **Rajah A1(c)**. Luas keratan rentas keluli ialah  $230\text{mm}^2$ , manakala aluminium pula  $150\text{mm}^2$ . Tentukan jumlah pemendekan pada gabungan bar bila dikenakan beban mampatan sebanyak 25kN.

[Diberi:  $E_k = 207\text{ GPa}$  dan  $E_a = 70\text{GPa}$ ]



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

[12 marks]

[12 markah]

## QUESTION 2

### SOALAN 2

CLO1  
C1

- (a) With the aid of a diagram, label the direction of reaction for pinned and fixed end supports.

Dengan bantuan gambarajah, labelkan arah tindak balas bagi penyokong pin dan hujung terikat.

[5 marks]

[5 markah]

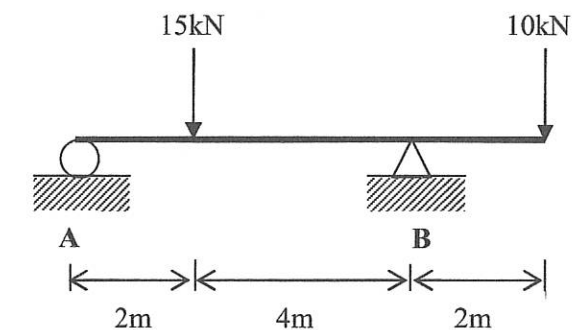
CLO2  
C2

- (b) Calculate the reaction force at each support of overhanging beam when subjected to the loads as shown in **Figure A2(b)** below.

Kirakan daya tindakbalas pada setiap penyokong bagi rasuk julur apabila dikenakan beban seperti dalam **Rajah A2(b)** di bawah.

[5 marks]

[5 markah]



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

CLO2  
C3

- (c) Based on the cantilever beam shown in **Figure A2(c)**, sketch a shear force diagram (SFD) and bending moment diagram (BMD) for the beam if  $A_y$  is 110 kN and  $M_A$  is -330 kNm.

Berdasarkan rasuk julus seperti dalam **Rajah A2(c)**, lakarkan gambarajah daya ricih (GDL) dan gambarajah momen lentur (GML) bagi rasuk tersebut jika nilai  $A_y$  ialah 110 kN dan  $M_A$  ialah -330 kNm.

[15 marks]

[15 markah]

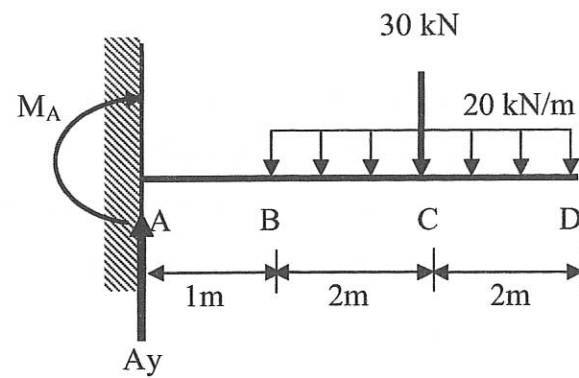


Figure A2(c)/ Rajah A2(c)

## 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

CLO2  
C1

- (a) Define bending stress and neutral axis of a beam.

Takrifkan tegasan lentur dan paksi neutral dalam rasuk.

[5 marks]

[5 markah]

CLO2  
C2

- (b) **Figure B1(b)** shows a T-section beam. Calculate the centroid of the section at y-axis and x-axis.

**Rajah B1(b)** menunjukkan sebuah rasuk berkeratan T. Kirakan sentroid keratan T tersebut pada paksi-y dan paksi-x.

[5 marks]

[5 markah]

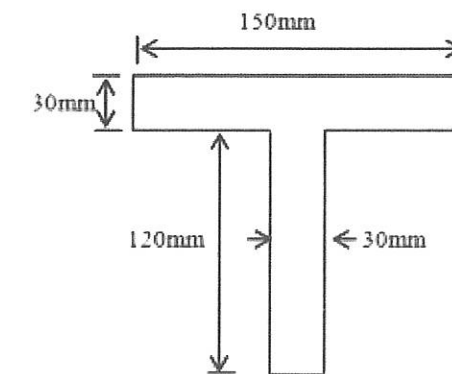
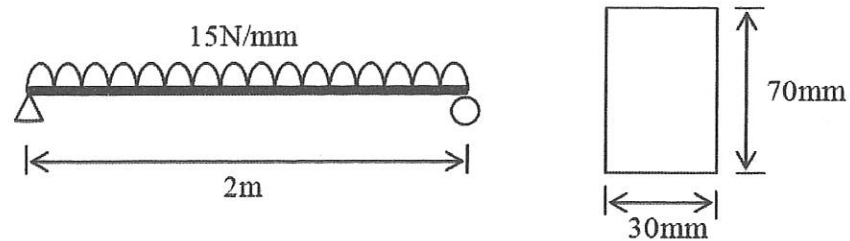


Figure B1(b)/ Rajah B1(b)

CLO2  
C3

- (c) A simply supported beam with rectangular section as shown in **Figure B1(c)** is subjected to a uniformly distributed load. Based on the figure below;  
*Rajah B1(c) menunjukkan sebuah rasuk tupang mudah berkeratan segiempat menerima beban teragih seragam. Berpandukan daripada gambarajah di bawah;*

Figure B1(c)/ *Rajah B1(c)*

- i. Calculate the maximum bending moment.  
*Kirakan momen lentur maksima.*
- [4 marks]  
[4 markah]
- ii. Calculate the second moment of area of the cross-section of a beam.  
*Kirakan momen luas kedua keratan rasuk tersebut.*
- [4 marks]  
[4 markah]
- iii. Calculate the maximum bending tension stress and the maximum bending compression stress of the cross section of a beam.  
*Kirakan tegasan lentur maksima dan tegasan mampatan maksima keratan rasuk itu.*
- [4 marks]  
[4 markah]
- iv. Sketch the bending stress distribution.  
*Lakarkan gambarajah taburan tegasan lentur.*
- [3 marks]  
[3 markah]

## QUESTION 2

## SOALAN 2

CLO2  
C1

- (a) Explain shear stress together with the formula and unit.  
*Terangkan tegasan ricih beserta formula dan unit.*

[5 marks]

[5 markah]

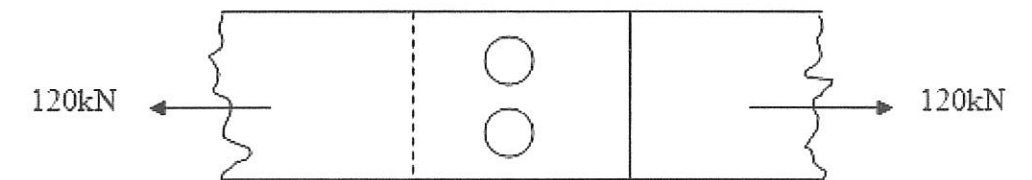
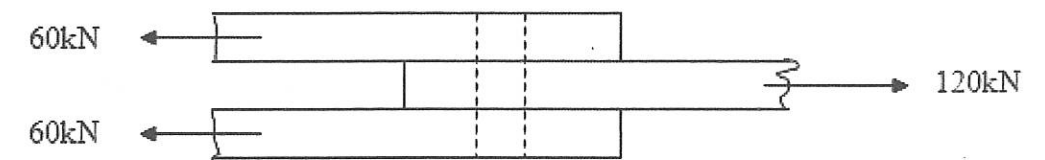
CLO2  
C2

- (b) Three steel plates as shown in **Figure B2(b)** are connected with 2 bolts of 18mm diameter. Calculate the shear stress in the bolts.

*Tiga keping plat keluli seperti yang ditunjukkan dalam Rajah B2(b) disambungkan menggunakan 2 bolt berdiameter 18mm. Kirakan tegasan ricih dalam bolt.*

[5 marks]

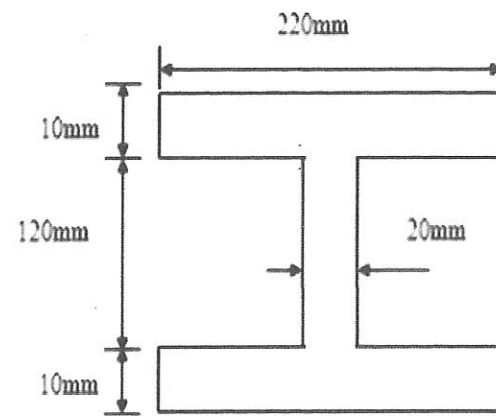
[5 markah]

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

CLO2  
C3

- (c) A symmetrical I-section beam as shown in **Figure B2(c)** is subjected to a shear force of 50kN.

*Satu rasuk simetri berkeratan I seperti dalam Rajah B2(c) telah dikenakan daya ricih sebanyak 50kN.*



**Figure B2(c) / Rajah B2(c)**

- i. Calculate the second moment of area for the section.  
*Kirakan momen luas kedua bagi keratan rentas tersebut.*

[3 marks]

[3 markah]

- ii. Calculate the shear stress at the neutral axis, flange and junction of the web.  
*Kirakan tegasan ricih pada paksi neutral, bebibir dan persimpangan web.*

[9 marks]

[9 markah]

- iii. Sketch the shear stress distribution for the whole section.  
*Lakarkan agihan tegasan ricih di seluruh bahagian.*

[3 marks]

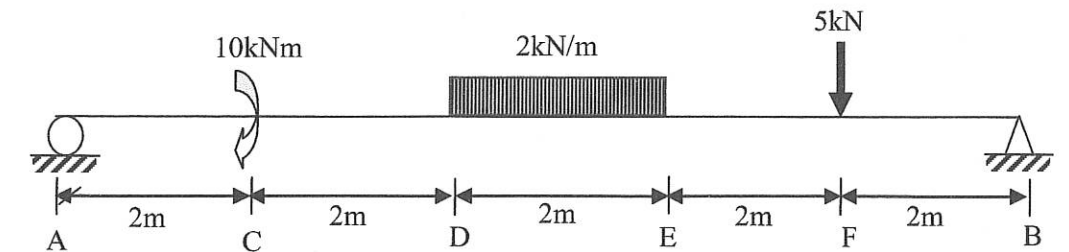
[3 markah]

## QUESTION 3

## SOALAN 3

A simply supported beam is subjected to a moment load at C, uniformly distributed load from D to E and a point load at F as shown in **Figure B3(c)**.

*Rasuk sokong mudah membawa beban momen di C, beban teragih seragam dari D ke E dan beban tumpu di F seperti dalam Rajah B3(c).*



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

CLO2  
C1

- (a) Based on **Figure B3(c)**:

*Merujuk kepada Rajah B3(c):*

- i. Draw the free body diagram for the beam. [3 marks]

*Lukis gambarajah jasad bebas bagi rasuk.* [3 markah]

- ii. Indicate the reaction force at support A. [2 marks]

*Nyatakan tindak balas pada penyokong A.* [2 markah]

CLO2  
C2

- (b) Express the slope and deflection equations for this beam by using Macaulay Method.  
*Tunjukkan persamaan kecerunan dan pesongan bagi rasuk ini dengan menggunakan Kaedah Macaulay.*

[5 marks]

[5 markah]

CLO2  
C3

- (c) Calculate the slope and deflection at point F by Macaulay Method.

*Kirakan kecerunan dan pesongan pada titik F dengan Kaedah Macaulay.*

[15 marks]

[15 markah]

## QUESTION 4

## SOALAN 4

A cantilever beam with I cross section is shown in **Figure B4**.

Satu rasuk julur berkeratan rentas I ditunjukkan seperti dalam **Rajah B4**.

[Given,  $E = 206 \text{ kN/mm}^2$ ]

[Diberi nilai,  $E = 206 \text{ kN/mm}^2$ ]

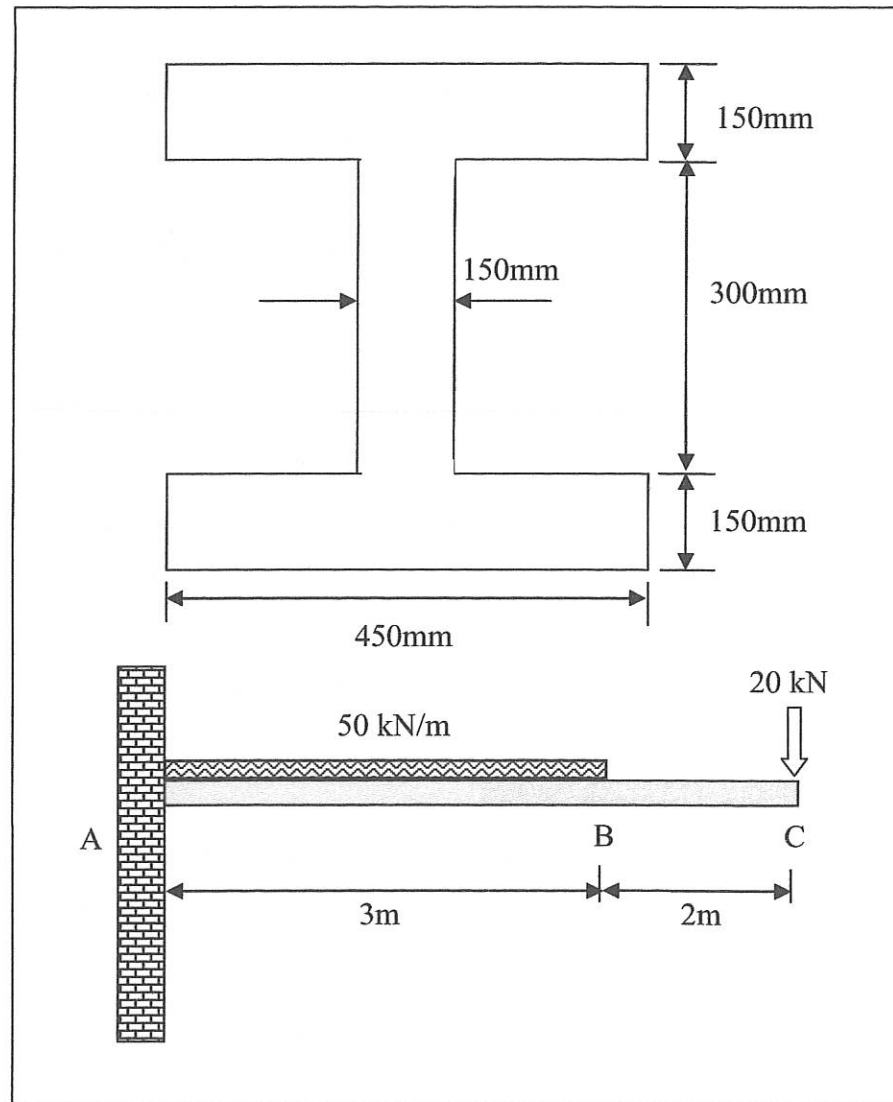
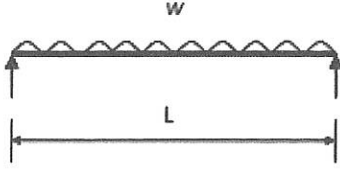
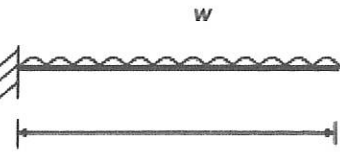
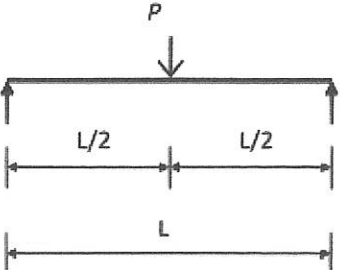
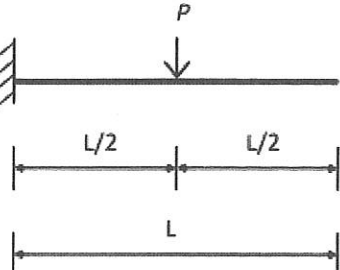


Figure B4/ Rajah B4

- CLO2 C1 (a) Indicate the second moment of area,  $I_{xx}$ .  
Nyatakan nilai momen luas kedua,  $I_{xx}$ .  
[5 marks]  
[5 markah]
- CLO2 C2 (b) Calculate reaction and the moment at the support.  
Kirakan tindak balas dan momen pada penyokong.  
[5 marks]  
[5 markah]
- CLO2 C3 (c) Using Moment Area Method, calculate the slope and deflection at the free end.  
Dengan menggunakan Kaedah Momen Luas, kirakan kecerunan dan pesongan pada hujung bebas.  
[15 marks]  
[15 markah]

SOALAN TAMAT

**Table 1: Maximum Moment Formula for Specific Beam and Load**

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

**LIST OF FORMULA FOR DCC 2063****MECHANICS OF CIVIL ENGINEERING STRUCTURES**

1.  $\sigma = \frac{P}{A}$
2.  $\varepsilon = \frac{\delta l}{L}$
3.  $E = \frac{PL}{\delta l \cdot A}$
4.  $E = \frac{\sigma}{\varepsilon}$
5.  $I_{xx} = \frac{bd^3}{12} + Ah^2$
6.  $Z = \frac{I}{Y_{max}}$
7.  $\frac{M}{I} = \frac{\sigma}{Y}$
8.  $\tau = \frac{F}{A}$
9.  $\tau = \frac{VAy}{I_{xx} \cdot b}$