

**SULIT**



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

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR  
SESI DISEMBER 2014**

**CC205: MECHANICS OF STRUCTURES**

**TARIKH : 06 APRIL 2015  
MASA : 11.15 AM - 01.15 AM (2 JAM)**

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Kertas ini mengandungi **TIGA BELAS (13)** halaman bercetak.  
Bahagian A: Struktur (10 soalan)  
Bahagian B: Esei (4 soalan)

Dokumen sokongan yang disertakan : ~~Kertas Graf~~, Formula dsb / ~~Tiada~~

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**



SULIT

CC205: MECHANICS OF STRUCTURES

SECTION A : 40 MARKS

**BAHAGIAN A : 40 MARKAH****INSTRUCTION :**

This section consists of **TEN (10)** short questions. Answer **ALL** questions.

**ARAHAN :**

*Bahagian ini mengandungi **SEPULUH (10)** soalan pendek. Jawab **SEMUA** soalan.*

**QUESTION 1****SOALAN 1**

CLO1  
C1 Define axial force and shear force with the aid of diagram.

*Berikan takrifan mengenai daya paksi dan daya ricich dengan bantuan gambarajah:*

[4 marks]

[4 markah]

**QUESTION 2****SOALAN 2**

CLO1  
C1 State **THREE (3)** principles of static equilibrium.

*Nyatakan **TIGA (3)** prinsip keseimbangan static.*

[4 marks]

[4 markah]

**QUESTION 3****SOALAN 3**

CLO1  
C3 Calculate the reaction at the support of a cantilever beam that is subjected to a load as shown in Diagram A1.

Kirakan nilai tindakbalas pada penyokong rasuk hujung terikat yang dikenakan beban seperti dalam Rajah A1.

[4 marks]  
[4markah]

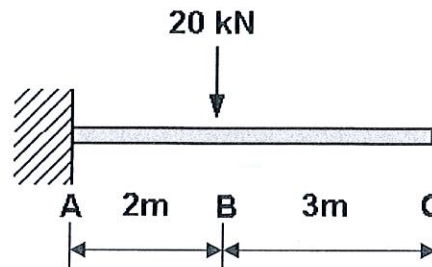


Diagram A1/ Rajah A1

$$F_x = 0$$

$$\sum F_y \uparrow = 0$$

$$\sum M_A \uparrow = 0$$

$$\sum M_A \uparrow = 0$$

$$-M - 20(2)$$

#### QUESTION 4

#### SOALAN 4

CLO1  
C1

- (a) Define Hooke's Law.  
*Takrifkan Hukum Hooke.*

[1 mark]

[1 markah]

CLO1  
C1

- (b) Define Modulus of Elasticity or Young Modulus.  
*Takrifkan Modulus Keanjalan or Modulus Young.*

[1 mark]

[1 markah]

CLO1  
C1

- (c) State TWO (2) mechanical characteristics of material.  
*Nyatakan DUA (2) ciri mekanikal bahan.*

[2 mark]

[2 markah]

## QUESTION 5

## SOALAN 5

CLO1  
C2

Diagram A5 shows a steel bar subjected to a compression load of 17kN. Determine the stress at section 1 and 2 of the bar.

*Rajah A5 menunjukkan satu bar keluli yang dikenakan beban mampatan 17kN. Tentukan tegasan pada bahagian 1 dan 2 keratan bar tersebut.*

[4 marks]

[4 markah]

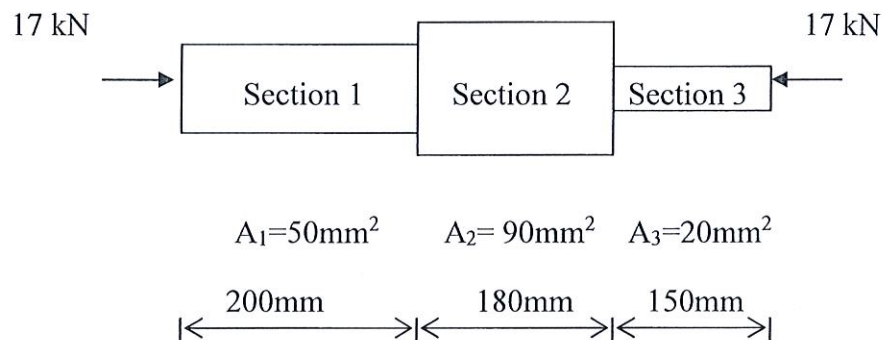


Diagram A5 / Rajah A5

## QUESTION 6

## SOALAN 6

CLO1  
C3

A hollow rod with 600mm length has outside and inside diameter of 30mm and 20mm respectively. If the rod is carrying a load of 50kN, and the elongation is 0.2mm, calculate the stress and strain of the rod.

*Sebatang rod berongga sepanjang 600mm yang mempunyai diameter luar dan dalam sebanyak 30mm dan 20mm. Jika rod tersebut menanggung beban sebanyak 50kN, dan pemanjangannya adalah 0.2mm, kirakan tegasan dan keterikan bagi rod tersebut.*

[4 marks]

[4 markah]

## QUESTION 7

## SOALAN 7

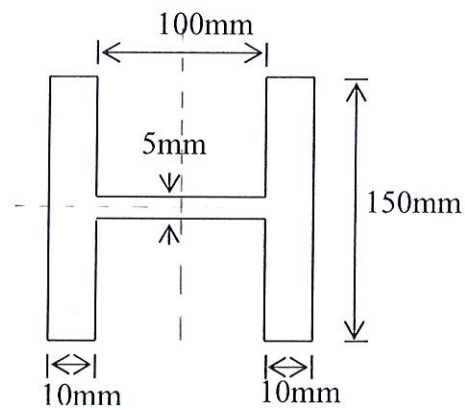
CLO1  
C2

Diagram A7 shows a H beam section. Calculate the centroid of the section at y axis and x axis.

*Rajah A7 menunjukkan satu keratan rasuk berbentuk H. Dapatkan pusat graviti bagi keratan tersebut pada paksi y dan paksi x.*

[4 marks]

[4 markah]



**Diagram A7 / Rajah A7**

## QUESTION 8

## SOALAN 8

CLO1  
C2

A rectangular column as shown in Diagram A8, is loaded eccentrically with  $P$  kN. Calculate the stresses that occur at the corner of A, B, C and D if  $P/A = 2.9 \text{ N/mm}^2$ ,  $M_{xx}/Z_{xx} = 2.5 \text{ N/mm}^2$  and  $M_{yy}/Z_{yy} = 2.3 \text{ N/mm}^2$ .

Rajah A8 menunjukkan tiang segiempat tepat yang dibebankan secara sipi dengan daya  $P$  kN. Kirakan tegasan yang berlaku pada setiap penjuru A, B, C dan D jika  $P/A = 2.9 \text{ N/mm}^2$ ,  $M_{xx}/Z_{xx} = 2.5 \text{ N/mm}^2$  dan  $M_{yy}/Z_{yy} = 2.3 \text{ N/mm}^2$ .

[4marks]

[4markah]

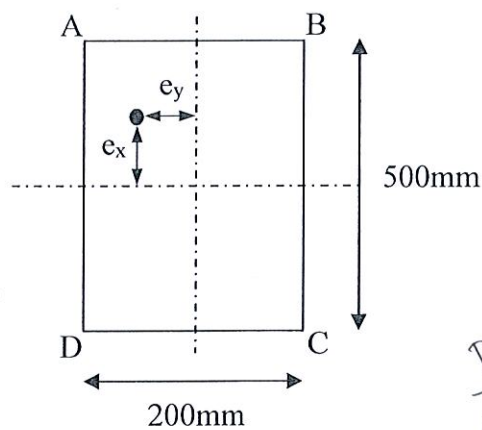


Diagram A8 / Rajah A8

$$\bar{u} = \frac{bh^3}{12}$$

100

$$\frac{P}{A}$$

$$\frac{P}{100000} = 2.9$$

## QUESTION 9

## SOALAN 9

CLO1  
C2

Three steel plates are connected by a bolt with 16 mm of diameter as shown in Diagram A9. Calculate the shear stress in the bolt.

Tiga keeping plat keluli disambungkan menggunakan satu bolt berdiameter 16 mm seperti ditunjukkan dalam Rajah A9. Kira tegasan ricih dalam bolt.

[4 marks]

[4 markah]

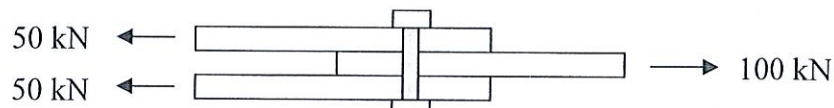


Diagram A9 / Rajah A9

$$\tau = \frac{V}{2An}$$

$$\frac{\pi d^2}{4}$$

## QUESTION 10

## SOALAN 10

CLO1  
C2

A cantilever beam is subjected to a load as shown in Diagram A10. Give the equation of moment, slope and deflection by using Macaulay Method.

Satu rasuk julur dikenakan beban seperti Rajah A10. Berikan persamaan momen, kecerunan dan pesongan dengan menggunakan Kaedah Macaulay.

[4 marks]

[4 markah]

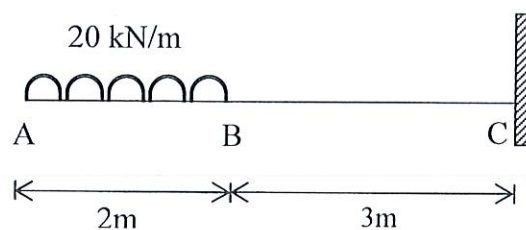


Diagram A10 / Rajah A10



## SECTION B : 60 MARKS

## BAHAGIAN B : 60 MARKAH

## INSTRUCTION :

This section consists of **FOUR (4)** structured questions. Answer **THREE (3)** questions only.

Arahan :

Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **TIGA (3)** soalan sahaja.

## QUESTION 1

## SOALAN 1

A simply supported beam is loaded as shown in Diagram B1.

Satu rasuk disokong mudah dikenakan beban seperti di dalam Rajah B1.

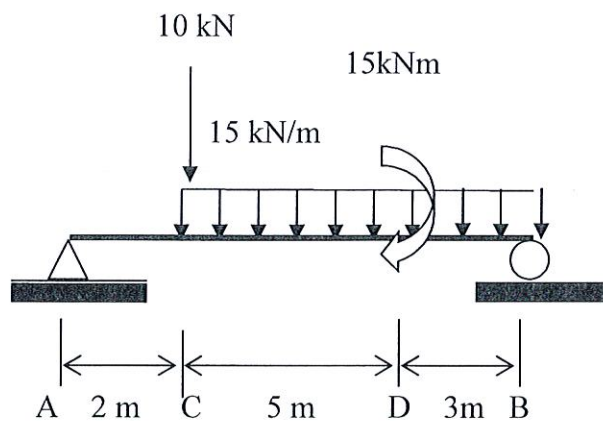


Diagram B1 / Rajah B1

$10 \text{ kN}$

$$\begin{aligned} F_A &= 54.5 \\ F_C &= 54.5 - 10 = 44.5 \\ F_C' &= 44.5 - 75 = -30.5 \\ F & \end{aligned}$$

$$\begin{aligned} F_A &= 54.5 \\ F_C &= 54.5 - 75 = -20.5 \\ F_C' &= -20.5 - 10 = -30.5 \\ F_D &= -30.5 - 45 = -75.5 \\ F_B &= -75.5 + 75.5 \end{aligned}$$

Based on Diagram B1, calculate;

Merujuk kepada Rajah B1, dapatkan ;

CLO1  
C3

(a) Reaction force at support A and B.

Daya tindakbalas pada penyokong A dan B.

[6 marks]

[6 markah]

CLO1  
C3 (b) Shear force and bending moment value  
*Nilai daya ricih dan momen lentur.*

[5 marks]

[5 markah]

CLO1  
C3 (c) Sketch shear force diagram (SFD) and bending moment diagram (BMD).  
*Lakarkan gambarajah daya ricih (GDR) dan gambarajah momen lentur (GML).*

[6 marks]

[6 markah]

CLO1  
C3 (d) Maximum bending moment.  
*Nilai momen lentur maksimum.*

[3 marks]

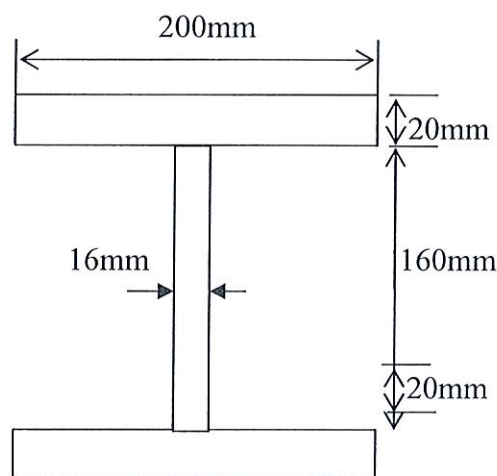
[3 markah]

## QUESTION 2

## SOALAN 2

Diagram B2 shows an I-section beam. Determine the maximum stress produced due to bending if the maximum bending is 180 kNm acting on the beam.

*Rajah B2 menunjukkan keratan rasuk benrbentuk I. Dapatkan tegasan lentur maksimum yang dialami rasuk tersebut sekiranya momen lentur maksimum yang bertindak di atas rasuk tersebut ialah 180 kNm.*



**Diagram B2 / Rajah B2**

CLO1  
C3

- (a) Centroid for each axis.  
*Kedudukan sentroid pada setiap paksi.*

[6 marks]

[6 markah]

CLO1  
C3

- (b) Second moment of area for beam cross section.  
*Momen luas kedua bagi keratan rentas rasuk.*

[7 marks]

[7 markah]

CLO1  
C3

- (c) Bending stress for beam cross section and sketch the bending stress distribution.  
*Tegasan lentur untuk keratan rentas rasuk dan lakarkan taburan tegasan lentur.*

[7 marks]

[7 markah]

## QUESTION 3

## SOALAN 3

CLO1  
C3

- (a) Three plates are connected with two rivets as shown in Diagram B3a. Calculate the diameter of rivet if the allowable stress is not more than  $50 \text{ MN/m}^2$ .

*Tiga keping plat disambung menggunakan dua rivet seperti dalam Rajah B3a.*

*Dapatkan diameter rivet jika tegasan yang dibenarkan tidak melebihi  $50 \text{ MN/m}^2$ .*

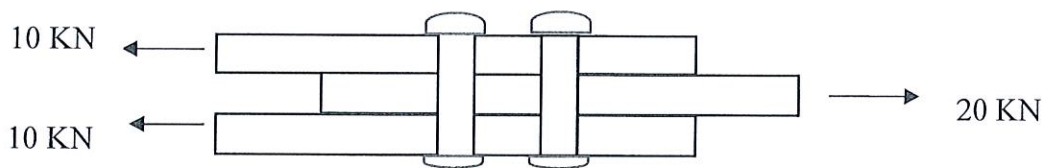


Diagram B3a / Rajah B3a

$$\frac{\pi d^2}{4} \quad \tau = \frac{V}{2An}$$

[5 marks]  
[5 markah]

CLO1  
C3

- (b) An I-section beam as shown in Diagram B3b is subjected to a shear force of  $50 \text{ KN}$ .

*Satu rasuk berkeratan I seperti dalam Rajah B3b telah dikenakan daya ricih sebanyak  $50 \text{ KN}$ .*

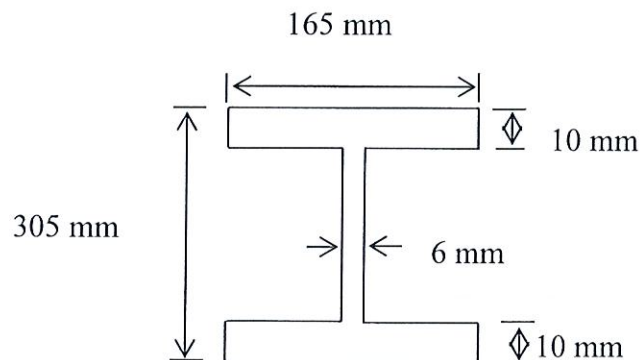


Diagram B3b / Rajah B3b

- i. Calculate the maximum shear stress of the I-section beam.

*Kirakan tegasan ricih maksimum pada rasuk berkenaan.*

[13 marks]

[13 markah]

- ii. Sketch the shear stress distribution diagram for the section and placed the maximum shear stress value in the diagram.

*Lakarkan taburan tegasan ricih keratan berkenaan dan letakkan nilai tegasan ricih maksima di dalam gambarajah tersebut.*

[2 marks]

[2 markah]

#### QUESTION 4

#### SOALAN 4

CLO1  
C3

A simply supported beam is subjected to a point load and distributed load as shown in Diagram B4. Calculate the slope and deflection at point C by using Macaulay Method.

*Satu rasuk disokong mudah dikenakan beban tumpu dan beban teragih seragam seperti dalam Rajah B4. Dapatkan kecerunan dan pesongan pada titik C dengan menggunakan kaedah Macaulay.*

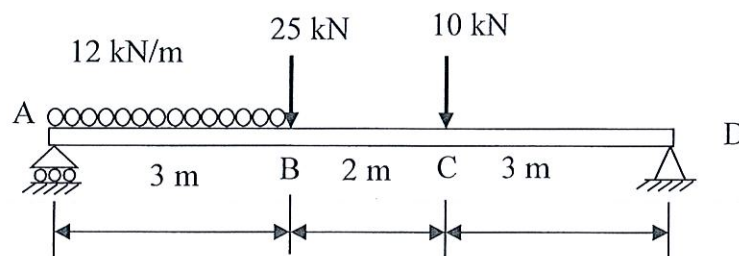


Diagram B4 / Rajah B4

[20 marks]

[20 markah]

#### SOALAN TAMAT

1000

1000



# LIST OF FORMULA FOR CC205 – MECHANICS OF STRUCTURES

1. 
$$\sigma = \frac{P}{A}$$

2. 
$$\varepsilon = \frac{\delta L}{L}$$

3. 
$$E = \frac{\sigma}{\varepsilon}$$

4. 
$$E = \frac{PL}{A\delta L}$$

5. 
$$I_{xx} = \frac{bd^3}{12}$$

6. 
$$I_{xx} = \frac{bd^3}{12} + Ah^2$$

7. 
$$Z = \frac{I}{y_{\max}}$$

8. 
$$\sigma = \frac{M}{I} \cdot y$$

9. 
$$\tau = \frac{VAy}{Ix \cdot b}$$

10. 
$$\sigma_{\max/\min} = \frac{P}{A} \pm \frac{Pe_x \bar{y}}{I_{xx}} \pm \frac{Pe_y \bar{x}}{I_{yy}}$$

