

SULIT



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

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2018

DJJ3103: STRENGTH OF MATERIAL

TARIKH : 08 NOVEMBER 2018

MASA : 11.15 PAGI - 1.15 TENGAHARI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.
Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab SEMUA soalan.

QUESTION 1**SOALAN 1**

CLO1
C1

(a) Define the terms as below and state its unit.

Definiskan istilah-istilah berikut dan nyatakan unitnya.

i. Stress
Tegasan

[2 marks]

[2 markah]

ii. Strain
Terikan

[2 marks]

[2 markah]

iii. Safety factor
Faktor keselamatan.

[2 marks]

[2 markah]

CLO1
C2

(b) A copper wire 4 m long was act by 100 kN of tensile load. If the stress applied is 60 MN/m^2 and given $E_{\text{copper}} = 112 \text{ GN/m}^2$, calculate:

Satu dawai kuprum panjang 4 m, dikenakan beban tegangan 100 kN. Jika tegasan yang berlaku di dalam kuprum ini adalah 60 MN/m^2 dan diberi nilai $E_{\text{kuprum}} = 112 \text{ GN/m}^2$, kirakan:

- i. The strain in the copper

Keterikan yang berlaku di dalam kuprum.

[2 marks]

[2 markah]

- ii. The elongation of copper.

Pemanjangan yang berlaku pada kuprum

[2 marks]

[2 markah]

- iii. The diameter of copper.

Diameter bagi kuprum

[4 marks]

[4 markah]

CLO1
C3

- (c) A series of bar consists of copper and aluminium bar which is fixed in between two rigid walls as **Figure 1(c)**. Determine the thermal stress induced in each bar if the temperature is increased by 80°C . Given that $E_{\text{aluminium}} = 69 \text{ GN/m}^2$ and $E_{\text{copper}} = 112 \text{ GN/m}^2$. $\alpha_{\text{aluminium}} = 23 \times 10^{-6} /^{\circ}\text{C}$, $\alpha_{\text{copper}} = 17 \times 10^{-6} /^{\circ}\text{C}$.

*Satu bar sesiri yang terdiri daripada kuprum dan aluminium dipasang tegar antara dua dinding seperti dalam **Rajah 1(c)**. Tentukan tegasan haba di dalam setiap bar tersebut jika suhu meningkat sebanyak 80°C . Diberi nilai $E_{\text{aluminium}} = 69 \text{ GN/m}^2$ dan $E_{\text{kuprum}} = 112 \text{ GN/m}^2$. $\alpha_{\text{aluminium}} = 23 \times 10^{-6} /^{\circ}\text{C}$, $\alpha_{\text{kuprum}} = 17 \times 10^{-6} /^{\circ}\text{C}$.*

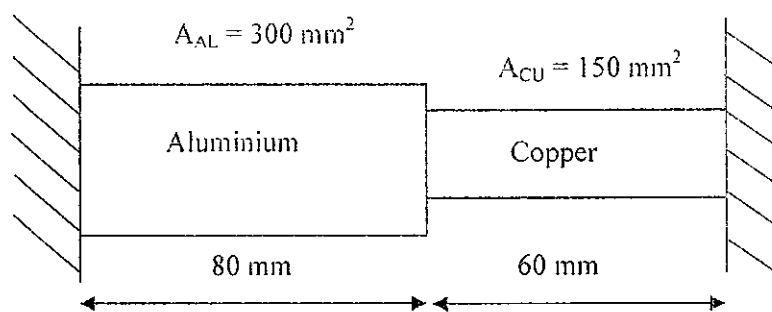


Figure 1(c)/ Rajah 1(c)

[11 marks]

[11 markah]

QUESTION 2

SOALAN 2

A simply support beam is shown in Figure 2.

Satu rasuk disokong mudah ditunjukkan seperti Rajah 2.

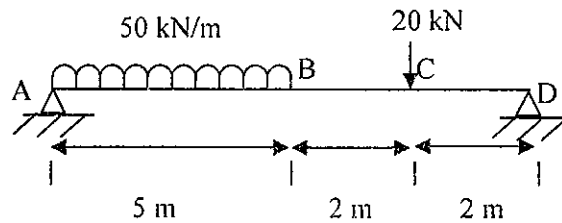


Figure 2/Rajah 2

CLO1
C2

- (a) Determine the reaction force on both supports.

Tentukan daya tindak balas di kedua hujung yang disokong.

[5 marks]

[5 markah]

CLO1
C3

- (b) Determine the shear force and draw the shear force diagram of the beam.

Tentukan daya ricih dan lakarkan gambarajah daya ricih bagi rasuk tersebut.

[10 marks]

[10 markah]

CLO1
C3

- (c) Determine bending moment and draw the bending moment diagram of the beam.

Tentukan momen lentur dan lakarkan gambarajah momen lentur bagi rasuk tersebut.

[10 marks]

[10 markah]

QUESTION 3

SOALAN 3

CLO1
C1

- (a) State the name of each quantity and its unit for the bending stress formula below.
Nyatakan nama dan unit bagi setiap kuantiti bagi rumus tegasan lentur di bawah.

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

[6 marks]

[6 markah]

CLO1
C2

- (b) A cantilever beam with L cross section is loaded with 3 kNm as moment at the edge as shown Figure 3(b) above. Given $E = 165 \text{ GN/m}^2$ and determine:

Sebatang rasuk julur yang berkeratan rentas L dikenakan momen 3 kNm diujung rasuk seperti Rajah 3(b) di atas. Diberikan $E = 165 \text{ GN/m}^2$, tentukan:

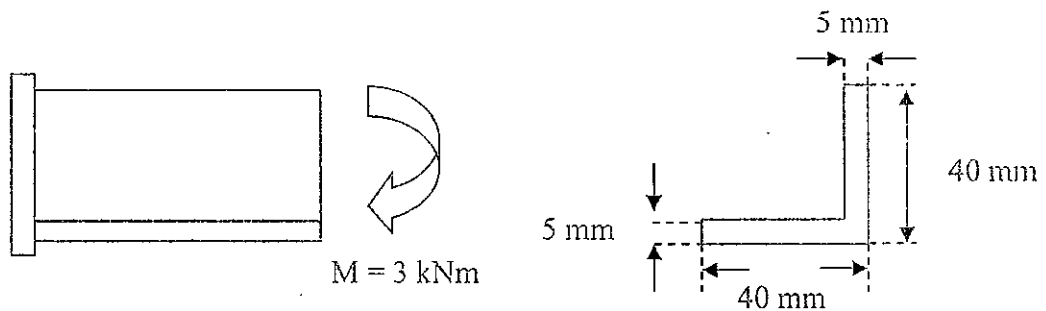


Figure 3(b)/Rajah 3(b)

- i. Neutral axis
Paksi neutral

[3 marks]

[3 markah]

- ii. Second area of moment

Momen luas kedua

[3 marks]

[3 markah]

- iii. Maximum bending stress.

Tegasan lentur maksimum.

[2 marks]

[2 markah]

CLO1
C3

- (c) A simply support beam shown in **Figure 3(c)** is loaded with Uniformly Distributed Load. Based on the figure, calculate the slope and deflection at position 3 m from point A by using Double Integration Method.

*Satu rasuk disokong mudah seperti **Rajah 3(c)** di atas dikenakan dengan daya teragih seragam. Berdasarkan rajah tersebut, tentukan kecerunan dan pesongan rasuk pada kedudukan 3 m dari titik A dengan menggunakan Kaedah Kamiran Berganda.*

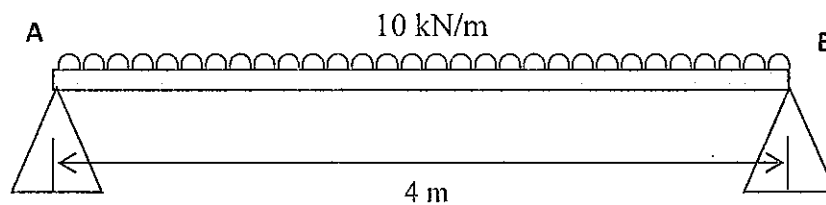


Figure 3(c)/ Rajah 3(c)

[11 marks]

[11 markah]

QUESTION 4

SOALAN 4

CLO1
C1

- (a) For the torsional equation, state the units for each quantity:

Bagi persamaan kilasan aci di bawah, nyatakan unit bagi setiap kuantiti dalam persamaan tersebut.

$$\frac{T}{J} = \frac{G\theta}{L}$$

[5 marks]

[5 markah]

CLO1
C2

- (b) A shaft with 50 mm diameter and 0.7 m long is subjected to torque of 1200 Nm. Calculate the shear stress and the angle of twist. Given
- $G = 90 \text{ GPa}$
- .

Satu aci berdiameter 50 mm dan panjangnya 0.7 m dikenakan dengan daya kilas sebanyak 1200 Nm. Kitakan tegasan ricih dan sudut kilas yang berlaku. Diberikan $G = 90 \text{ GPa}$.

[7 marks]

[7 markah]

CLO1
C3

- (c) A shaft with a diameter of 300 mm and length of 2 m transmits 250 kW power at 120 r.p.m. If the modulus of rigidity of the shaft is 100 GN/m^2 , calculate:

Satu aci yang berdiameter 300 mm dan panjang 2 m menghasilkan 250 kW kuasa pada 120 p.p.m. Jika modulus ketegaran aci adalah 100 GN/m^2 , kirakan:

- i. The maximum shear stress in the shaft.

Tegasan ricih maksimum di dalam aci

[7 marks]

[7 markah]

- ii. Angle of twist, in radian.

Sudut kilasan dalam unit radian

[3 marks]

[3 markah]

- iii. Shear stress at a radial distance of $r = 100 \text{ mm}$.

Tegasan ricih pada jejari aci, $r = 100 \text{ mm}$.

[3 marks]

[3 markah]

SOALAN TAMAT