

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 **TUJUH (7)** 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 below :
Definasikan istilah dibawah:

- i. Young's Modulus
Modulus Young
- ii. Lateral strain
Keterikan sisi
- iii. Longitudinal strain
Keterikan membujur

[5 marks]

[5 markah]

CLO1
C2

- (b) A bar with thickness of 21 mm and a rectangular cross section carries a load of 150 kN. Determine the minimum width of the bar to limit the maximum stress to 300 MPa. The bar, which is 1.5 m long, extends by 3.2 mm when carrying a load. Determine the modulus of elasticity of the material.

Sebatang bar dengan ketebalan 21 mm mempunyai keratan rentas segiempat tepat membawa beban sebanyak 150 kN. Tentukan lebar minimum bar untuk had maksimum stress kepada 300 MPa. Panjang bar 1.5 m, pemanjangan 3.2 mm apabila membawa beban. Tentukan modulus keanjalan bahan tersebut.

[7 marks]

[7 markah]

CLO1
C4

- (c) A composite rod consists of aluminium and copper rod which are bonded rigidly with initial temperature of 28°C . The copper rod is inserted into the aluminium tube which has inner and outer diameter of 15mm and 35mm respectively. The length of the rod is assumed to be the same. Calculate the stress in each rod when temperature is raised to 78°C . What is the related between temperature change and stress.

Given:

$$E_{\text{copper}} = 120 \text{ GPa},$$

$$E_{\text{aluminium}} = 70 \text{ GPa}$$

$$\alpha_{\text{copper}} = 17 \times 10^{-6} / ^{\circ}\text{C}$$

$$\alpha_{\text{aluminium}} = 23 \times 10^{-6} / ^{\circ}\text{C}$$

Satu rod majmuk diperbuat daripada rod aluminium dan rod tembaga yang di iikat tegar dengan suhu awal 28°C . Rod tembaga berada di dalam tiub aluminium di mana diameter luar 15mm dan diameter dalam 35mm masing-masing. Andaikan panjang kedua-dua rod adalah sama. Kirakan tegasan pada setiap rod apabila suhu dinaikkan kepada 78°C .

Diberi:

$$E_{\text{copper}} = 120 \text{ GPa},$$

$$E_{\text{aluminium}} = 70 \text{ GPa}$$

$$\alpha_{\text{copper}} = 17 \times 10^{-6} / ^{\circ}\text{C}$$

$$\alpha_{\text{aluminium}} = 23 \times 10^{-6} / ^{\circ}\text{C}$$

[13 marks]
[13 markah]

QUESTION 2

SOALAN 2

The simply supported beam is loaded as shown in Figure 2 below.

Satu rasuk disangga mudah dikenakan bebanan seperti Rajah 2 di bawah.

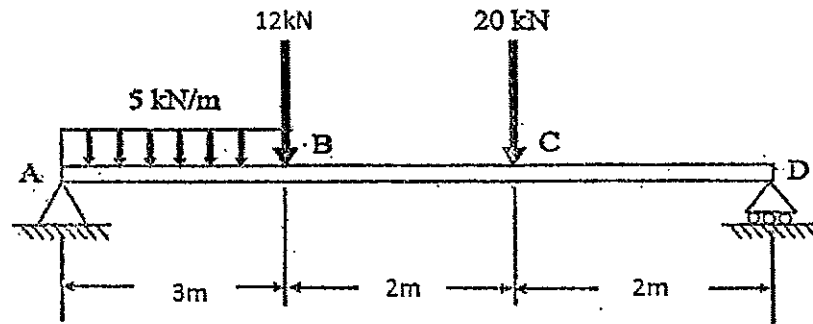


Figure 2 / Rajah 2

CLO 1
C2

(a) Determine the reaction force at point A and D.

Tentukan daya tindakbalas pada titik A dan D.

[5 marks]

[5 markah]

CLO 1
C3

(b) Calculate the shear force and bending moment at point ABCD.

Kirakan daya ricih dan momen lentur pada titik ABCD.

[12 marks]

[12 markah]

CLO 1
C4

(c) i. Draw the shear force diagram and bending moment diagram.

Lukiskan gambarajah daya ricih dan gambarajah momen lentur.

[6 marks]

[6 markah]

ii. Determine the value of the maximum bending moment.

Tentukan nilai momen lentur maksimum.

[2 marks]

[2 markah]

QUESTION 3

SOALAN 3

A hollow rectangular beam with simply supported over a span of 10 m. The beam carries a uniform distributed load of 10 kN/m and a concentrated load of 20 kN at mid-span as shown in Figure S3(a). Dimension of the beam is 150 mm x 250 mm as shown in Figure S3b. Given, $E = 210 \text{ GN/m}^2$.

Sebatang rasuk berkeratan rentas segi empat tepat berongga disokong mudah dengan panjang 10 m. Rasuk dikenakan beban teragih seragam 10 kN/m dan beban tumpu 20 kN pada tengah rasuk seperti yang ditunjukkan dalam Rajah S3a. Dimensi rasuk adalah 150 mm x 250 mm seperti yang ditunjukkan dalam Rajah S3b. Diberi, $E = 210 \text{ GN/m}^2$.

CLO1
C1

- (a) Draw the free body diagram and calculate the reaction force. [5 marks]
Kenalpasti daya tindak balas pada titik A dan B [5 markah]

CLO1
C2

- (b) Calculate The Second Moment of Area of the beam [6 marks]
Kirakan Momen Kedua Luas bagi keratan rentas rasuk [6 markah]

CLO1
C3

- (c) i. Carry out the equation of the elastic curve of the beam [10 marks]
Persamaan lengkung elastik rasuk [10 markah]

- ii. Calculate the slope at end of point A and B. [4 marks]
Kirakan kecerunan pada titik A dan B. [4 markah]

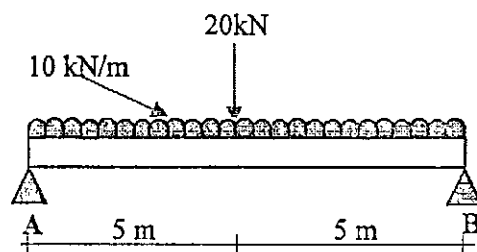


Figure S3(a)

Rajah S3(a)

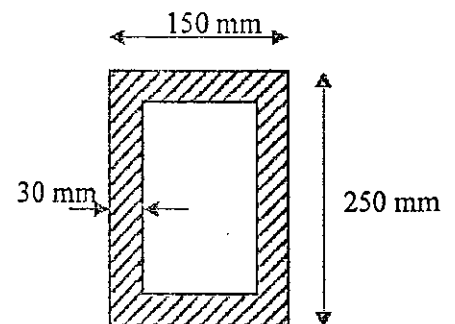


Figure S3(b)

Rajah S3(b)

QUESTION 4
SOALAN 4

- CLO1
C1 (a) Define the symbol along with their unit for engineering terms (TORSION FORMULA) below:

Terangkan maksud simbol beserta unit bagi istilah kejuruteraan (FORMULA KILASAN) di bawah:

- i. T
- ii. J
- iii. θ

[5 marks]

[5 markah]

- CLO1
C2 (b) A steel shaft of 1m long that has a diameter of 50 mm is subjected to a torque of 700 Nm. Determine the maximum shearing stress and the angle of twist (in degrees unit). Use $G = 79 \text{ GPa}$.

Sebatang 1m panjang aci besi yang mempunyai 50mm diameter telah dikenakan daya kilasan sebanyak 700 Nm. Tentukan nilai tegasan ricih maksimum dan sudut kilasan aci (dalam unit darjah) tersebut. Diberi $G = 79 \text{ GPa}$.

[8 marks]

[8 markah]

CLO1
C3

(c)

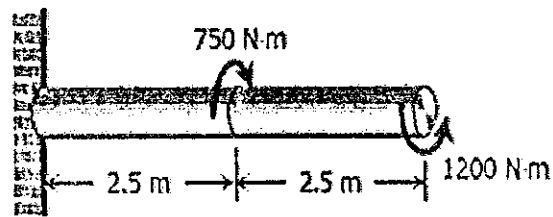


Figure 4(c) / Rajah 4c

A solid steel shaft is loaded as shown in Figure 4(c). Using $G = 83 \text{ GPa}$, determine the required diameter of the shaft if the angle of rotation at the free end does not exceed 4° .

Bar bulat padu aci besi telah dikenakan beban seperti dalam Rajah 4(c), diberi $G = 83 \text{ Gpa}$. Tentukan diameter aci sekiranya sudut kilasan di hujung aci tidak lebih dari 4° .

[12 marks]

[12 markah]

SOALAN TAMAT