SULIT

POLITEKNIK MALAYSIA
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BAHAGIAN PEPERIKSAAN DAN PENILAIAN

JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PENILAIAN ALTERNATIF BERIKUTAN

PELAKSANAAN PERINTAH KAWALAN BERSYARAT

SESI JUN 2020

DJJ30103 / DJJ3103 : STRENGTH OF MATERIALS

NAMA PENYELARAS KURSUS : ASRI BIN MAT DESA

KAEDAH PENILAIAN : PEPERIKSAAN ONLINE

JENIS PENILAIAN : SOALAN ESEI BERSTRUKTUR (2 SOALAN)

TARIKH PENILAIAN : 4 FEBRUARI 2021

TEMPOH PENILAIAN : 1 JAM

LARANGAN TERHADAP PLAGIARISM (AKTA 174)
PELAJAR TIDAK BOLEH MEMPLAGIAT APA-APA IDEA, PENULISAN, DATA ATAU CIPTAAN ORANG LAIN. PLAGIAT ADALAH SALAH SATU PENYELEWENGAN AKADEMIK. SEKIRANYA PELAJAR DIBUKTIKAN MELAKUKAN PLAGIARISM, PENILAIAN BAGI KURSUS BERKENAAN AKAN DIMANSUHKAN DAN DIBERI GRED F DENGAN NILAI MATA 0.

(RUJUK BUKU ARAHAN-ARAHAN PEPERIKSAAN DAN KAEDAH PENILAIAN (Diploma) EDISI 6, JUN 2019, KLAUSA 17.3)

INSTRUCTION:
This section consists of **TWO (2)** structured essay questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan esei berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO3
C3

(a) A hollow mild steel has an outer diameter of 30mm, thickness of 5mm and 1.5m length. A solid rod of copper is fixed inside. The composite bar is rigidly fixed at both ends. Calculate the stress developed in each bar when the temperature is increased to 70◦C.

Sebatang keluli lembut bergeronggang mempunyai diameter luar 30mm, ketebalan 5mm dan Panjang 1.5m. Sebatang rod kuprum dipasang didalam keluli tersebut. Bar komposit ini dipasang tegar di kedua dua hujung. Kirakan tegasan yang berlaku pada setiap bar suhu dinaikkan ke 70◦C.

Given,

$\mathbf{E}_{steel} = 206\ GN/m^2$ $\alpha_{steel} = 12 \times 10^{-6}/^0\ C$
$\mathbf{E}_{copper} = 109\ GN/m^2$ $\alpha_{copper} = 18.5 \times 10^{-6}/^0\ C$

Diberi:

$\boldsymbol{E}_{keluli} = 206\ GN/m^2$ $\alpha_{keluli} = 12 \times 10^{-6}/^o\ C$
$\boldsymbol{E}_{kuprum} = 206\ GN/m^2$ $\alpha_{kuprum} = 18.5 \times 10^{-6}/^o\ C$

[15 marks]
[*15 markah*]

CLO3
C4

(b) Determine the bending moment value along the beam and sketch the bending moment diagram as shown at **Figure 1**.

*Tentukan nilai momen lentur sepanjang rasuk dan lakarkan gambar rajah momen lentur seperti ditunjukkan pada **Rajah 1.***

[10 marks]
[*10 markah*]

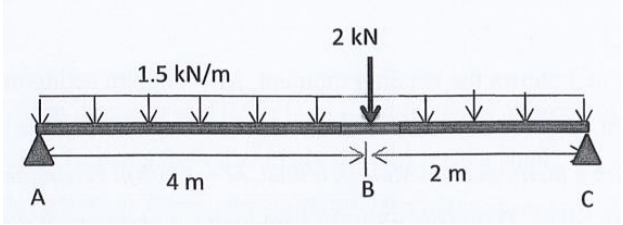


Figure 1 / *Rajah 1*

QUESTION 2
SOALAN 2

CLO3
C3

(a) A 5m long simply supported beam is given a point load of 20kN at the middle of the beam. Calculate the maximum deflection of the beam. Given E=190GN/m² and I = 13.5 x 10^{-6} m^4.

Sebatang rasuk disokong mudah sepanjang 5m dikenakan beban tumpu sebanyak 20kN di pertengahan rasuk. Kirakan pesongan maksimum rasuk. Diberi E=190GN/m² and I = 13.5 x 10^{-6} m^4.

[20 marks]
[*20 markah*]

CLO3
C3

(b) Calculate the distance of maximum deflection of the beam that occurs;

Kirakan jarak pesongan rasuk maksimum yang berlaku;

[5 marks]
[*5 markah*]

SOALAN TAMAT

LIST OF FORMULA

FORCES ON MATERIALS

1. Safety factor = $\frac{\text{Maximum Stress}}{\text{Work Stress}}$

2. Poisson's Ratio, $\nu = \frac{\text{laterial strain}}{\text{longitudinal strain}}$

3. Percent Elongation = $\frac{\text{Elongation}}{\text{Length}} \times 100\ \%$

4. Percent reduction in area = $\frac{A_f - A_o}{A_o} \times 100\ \%$

5. Strain Energy, $U = \frac{1}{2} P\Delta L$

THERMAL STRESSES AND COMPOSITE BARS

1. Equation of a parallel composite bar subjected to a temperature change.

$$\frac{\sigma_1}{E_1} + \frac{\sigma_2}{E_2} = (\alpha_2 - \alpha_1)\,\Delta t$$

2. Equation of a series composite bar subjected to a temperature change.

$$\frac{P_1 L_1}{A_1 E_1} + \frac{P_2 L_2}{A_2 E_2} = \Delta t(\alpha_1 L_1 + \alpha_2 L_2)$$

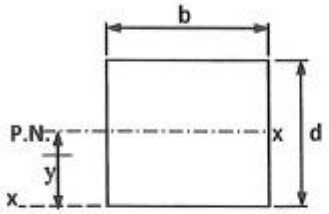
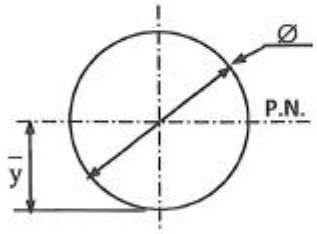
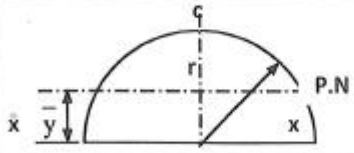
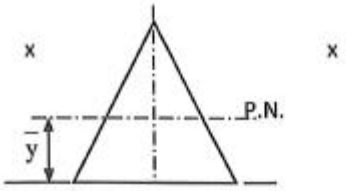
SHEAR FORCES AND BENDING MOMENT

$$\sum M_A \circlearrowright = \sum M_A \circlearrowleft$$

$$\sum F \uparrow = \sum F \downarrow$$

BENDING STRESS

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

SHAPE	CENTROID	MOMENT OF INERTIA
	$\bar{x}=b/2$ $\bar{y}=d/2$	$I_{P.N.}=\frac{bd^3}{12}$ $I_{xx}=\frac{bd^3}{3}$
	$\bar{x}=d/2$ $\bar{y}=d/2$	$I_{P.N.}=\frac{\pi d^4}{64}=\frac{\pi r^4}{4}$
	$\bar{y}=\frac{4r}{3\pi}$	$I_{P.N}=0.11\,r^4$ $I_{xx}=\frac{\pi r^4}{8}$
	$\bar{y}=h/3$	$I_{P.N.}=\frac{bh^3}{36}$ $I_{xx}=\frac{bh^3}{12}$ $I_{yy}=\frac{hb^3}{48}$

TORSION OF SHAFT

1. TORSION FORMULA

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

2. POLAR MOMENT OF INERTIA

$$J=\frac{\pi d^4}{32}$$

3. SERIES COMPOSITE SHAFT

$$T=\frac{G_1\theta J_1}{L_1}=\frac{G_2\theta_2 J_2}{L_2}$$

$$\theta_{AC}=\theta_{AB}+\theta_{BC}$$

$$=\frac{T_1L_1}{G_1J_1}+\frac{T_2L_2}{G_2J_2}$$

$$=T\left(\frac{L_1}{G_1J_1}+\frac{L_2}{G_2J_2}\right)$$

4. PARALLEL COMPOSITE SHAFT

$$T = T_1 + T_2$$

$$\theta=\left(\frac{T_1L_1}{G_1J_1}\right)=\left(\frac{T_2L_2}{G_2J_2}\right)$$