



**KOLEJ YAYASAN PELAJARAN JOHOR
PEPERIKSAAN AKHIR**

NAMA KURSUS : REKABENTUK KEJURUTERAAN
KOD KURSUS : DKM 2153
PEPERIKSAAN : APRIL 2019
MASA : 2 JAM 30 MINIT

ARAHAN KEPADA CALON

1. Kertas ini mengandungi **SATU (1)** bahagian sahaja:
2. Kertas soalan ini mengandungi **LIMA (5)** soalan. Jawab **EMPAT (4)** soalan sahaja.
3. Calon tidak dibenarkan membawa masuk sebarang peralatan ke dalam bilik peperiksaan kecuali dengan kebenaran pengawas peperiksaan.
4. Sila pastikan bahan-bahan berikut diperolehi untuk sesi peperiksaan ini:
 - i. Kertas Soalan
 - ii. Buku Jawapan

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

KERTAS SOALAN INI MENGANDUNGI 6 HALAMAN BERCETAK TERMASUK MUKA HADAPAN

Bahagian ini mengandungi **LIMA (5)** soalan.

Jawab **EMPAT (4)** soalan sahaja. Jawab dalam Buku Jawapan.

QUESTION 1

SOALAN 1

- a. Compare Maximum-Shear-Stress Theory for ductile and Maximum-Shear-Stress Theory for brittle materials.

Bandingkan Teori Tekanan-Ricik-Maksimum untuk bahan mulur dan Teori Tekanan-Normal-Maksimum untuk bahan rapuh.

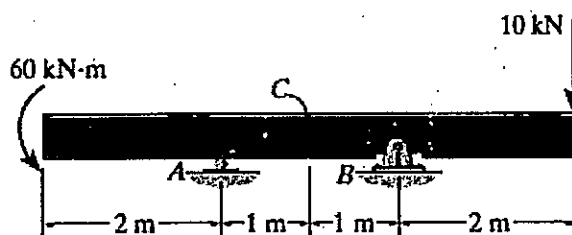
(5 marks)

(5 markah)

- b. Calculate the internal normal force, shear force, and bending moment at point C for the following beam:

Kirakan daya normal, daya ricih, dan momen lenturan di titik C bagi setiap rasuk yang berikut:

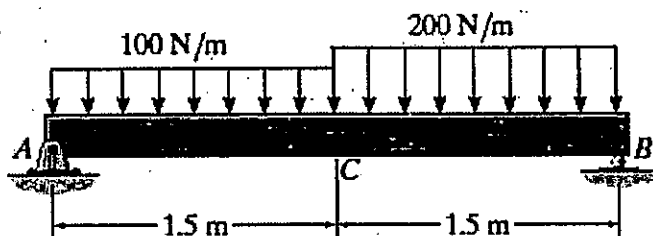
(i)



(10 marks)

(10 markah)

(ii)



(10 marks)

(10 markah)

QUESTION 2

SOALAN 2

- a. Define mechanical fasteners and elaborate three (3) main categories of threaded fasteners.

Takrifkan pengikat mekanikal dan huraikan tiga (3) kategori utama pengikat bebenang.

(8 marks)

(8 markah)

- b. The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm^2 .

It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa.

Sebuah kepala silinder enjin wap dikenakan tekanan wap pada 0.7 N/mm^2 . Ia dipegang oleh 12 bolt. Gasket tembaga yang lembut digunakan untuk membuat sambungan anti-bocor. Diameter silinder yang berkesan ialah 300 mm. Cari saiz bolt supaya tekanan di bolt tidak melebihi 100 MPa.

(17marks)

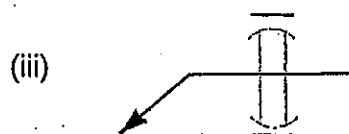
(17 markah)

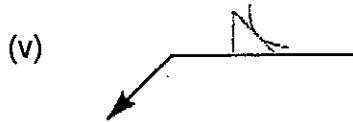
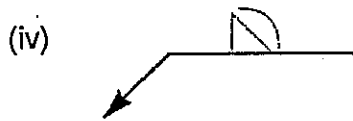
QUESTION 3

SOALAN 3

- a. Define the following welding's supplementary symbol.

Takrifkan simbol tambahan kimpalan yang berikut.





(5 marks)

(5 markah)

- a. A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld so that the maximum stress does not exceed 56 MPa by considering the first joint is under:

Sekeping plat dengan 100 mm lebar dan 12.5 mm tebal hendak dikimpal bersama plat lain dengan cara kimpalan fillet selari. Plat tersebut dikenakan beban 50 kN. Cari panjang kimpalan supaya tegasan maksimum tidak melebihi 56 MPa dengan mempertimbangkan sambungan pertama berada di bawah:

- (i) static loading/beban statik

(10 marks)

(10 markah)

- (ii) fatigue loading/beban keletihan

(10 marks)

(10 markah)

QUESTION 4

SOALAN 4

- a. List six (6) advantages and four (4) disadvantages of rolling contact bearings over sliding contact bearings.

Senaraikan enam (6) kelebihan dan empat (4) kekurangan galas 'rolling contact' berbanding galas 'sliding contact'.

(10 marks)

(10 markah)

- b. A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3kN for 10 per cent of time, 2kN for 20 per cent of time, 1kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing.

Aci berputar pada kelajuan malar dikenakan beban berubah-ubah. Galas yang menyokong aci dikenakan kepada beban radikal bersamaan yang bergerak 3kN selama 10 peratus masa, 2kN untuk 20 peratus masa, 1kN untuk 30 peratus masa dan tiada beban untuk masa kitaran yang tinggal. Jika jumlah hayat yang dijangkakan untuk galas adalah 20×10^6 revolusi pada 95% kebolehpercayaan, hitung nilai beban dinamik galas bebola tersebut.

- (i) Bearing life at 90 per cent reliability/hayat galas pada 90%

(9 marks)

(9 markah)

- (ii) Radial load/beban 'radial'

(3 marks)

(3 markah)

- (iii) Dynamic load rating/beban dinamik galas

(3 marks)

(3 markah)

SOALAN 5

QUESTION 5

- a. List five (5) requirements that must be followed in designing a gear drive.

Senaraikan lima (5) keperluan yang mesti diikuti dalam mereka bentuk pemacu gear.

(5 marks)

(5 markah)

- b. Pinion 2 in Figure 1 runs at 1750 rev/min and transmits 2.5 kW to idler gear 3. The teeth are cut on the 20° full-depth system and have a module of $m = 2.5$ mm. Draw a free-body diagram of gear 3 and show all the forces that act upon it.

Pinion 2 dalam gambar Rajah 1 beroperasi pada 1750 putaran/min dan memindahkan 2.5 kW kuasa kepada gear 3. Gigi gear dipotong pada 20° kedalaman penuh sistem dan memiliki modul, $m = 2.5$ mm. Lakarkan gambar rajah jasad bebas gear 3 dan tunjukkan semua daya yang bertindak ke atasnya.

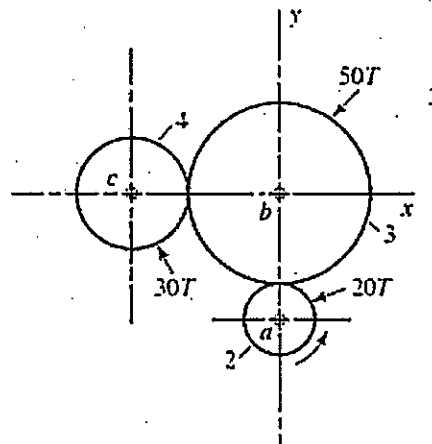


Figure 1 Gear train/Rajah 1 Sambungan gear

(20 marks)

(20 markah)

[100 MARKAH]

KERTAS SOALAN TAMAT

LIST OF FORMULA
(1) Screw and Fasteners

$$T_R = \frac{F d_m}{2} \left(\frac{l + \pi f d_m}{\pi d_m - f l} \right) + \frac{F f_c}{2} d_c$$

$$T_L = \frac{F d_m}{2} \left(\frac{\pi f d_m - l}{\pi d_m + f l} \right) + \frac{F f_c}{2} d_c$$

$$e = \frac{F l}{2 \pi T_R} \quad \tau = \frac{16 T_R}{\pi d_r^3} \quad \sigma = -\frac{4 F}{\pi d_r^2}$$

(2) Welding
(i) Tensile strength for single fillet weld

$$P = 0.707 s \times l \times \sigma_t$$

(ii) Shear stress for single fillet weld

$$P = 0.707 s \times l \times \tau$$

(iii) Throat area

$$A = 0.707 s \times l$$

(3) Bearing
(i) Bearing life

$$\frac{L_{95}}{L_{90}} = \left[\frac{\log_e \left(\frac{1}{R_{95}} \right)}{\log_e \left(\frac{1}{R_{90}} \right)} \right]^{1/b}$$

(ii) Radial load

$$W = \left[\frac{n_1 (W_1)^3 + n_2 (W_2)^3 + n_3 (W_3)^3 + \dots}{n_1 + n_2 + n_3 + \dots} \right]^{1/3}$$

(iii) Dynamic Load Rating

$$C = W \left[\frac{L_{90}}{10^6} \right]^{1/k}$$

(4) Gear
(i) Pitch line velocity

$$v = \frac{\pi D_p N_p}{60} = \frac{\pi m \cdot T_p N_p}{60}$$

(ii) Tangential tooth load

$$W_T = \frac{P}{v} \times C_s$$

(iii) Tooth form factor for pinion

$$y_p = 0.154 - \frac{0.912}{T_p}$$

(iii) Tooth form factor for gear

$$y_g = 0.154 - \frac{0.912}{T_g}$$

LIST OF TABLE

Table 1 Values of K for various types of joints

<i>Type of joint</i>	$K = \frac{a}{1+a}$
Metal to metal joint with through bolts	0.00 to 0.10
Hard copper gasket with long through bolts	0.25 to 0.50
Soft copper gasket with long through bolts	0.50 to 0.75
Soft packing with through bolts	0.75 to 1.00
Soft packing with studs	1.00

Table 2 Stress concentration factor for welded joints

<i>Type of joint</i>	<i>Stress concentration factor</i>
1. Reinforced butt welds	1.2
2. Toe of transverse fillet welds	1.5
3. End of parallel fillet weld	2.7
4. T-butt joint with sharp corner	2.0

Table 3 Values of service factor

<i>Type of load</i>	<i>Type of service</i>		
	<i>Intermittent or 3 hours per day</i>	<i>8-10 hours per day</i>	<i>Continuous 24 hours per day</i>
Steady	0.8	1.00	1.25
Light shock	1.00	1.25	1.54
Medium shock	1.25	1.54	1.80
Heavy shock	1.54	1.80	2.00

