SULIT

POLITEKNIK MALAYSIA

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

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2018

DJJ5113: MECHANICS OF MACHINES

TARIKH : 30 OKTOBER 2018
MASA : 11.15 PAGI - 1.15 TENGAHARI (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.
Struktur (4 soalan)
Dokumen sokongan yang disertakan : Kertas Graf & Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

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

ARAHAN :

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

QUESTION 1

SOALAN 1

CLO1
C1

(a) A lifting machine is used to raise up M kg of load with acceleration, a. Sketch the free body diagram for the system. From the diagram, write the formula for tension of the rope, P and driven torque, τ. Ignore the friction torque.

Sebuah mesin angkat digunakan untuk menaikkan beban seberat M kg dengan pecutan, a. Lakarkan gambarajah badan bebas untuk sistem tersebut. Tuliskan formula untuk ketegangan tali, P dan tork pemacu, τ dari gambarajah yang dilakar. Abaikan tork geseran.

[5 marks]

[*5 markah*]

CLO1
C2

(b) A mine cage with a mass of 3500 kg is raised with uniform velocity. Drum of hoisting machine has a diameter of 1.8 m, mass of 900 kg and radius of gyration of 550 mm. Determine the torque required at the drum of lifting machine.

Satu sangkar yang mempunyai berat 3500 kg diangkat dengan halaju malar. Drum pada mesin angkat mempunyai diameter 1.8 m, berat 900 kg dan jejari kisaran 550 mm. Tentukan nilai tork yang diperlukan oleh drum mesin angkat ini.

[7 marks]

[*7 markah*]

CLO1
C3

(c) Tied at two ends of a rope are two loads with mass of 15 kg and 5 kg respectively. A rope is tied around the drum with a moment of inertia of 0.86 kgm^2 and 920 mm in diameter. Calculate the following by ignoring the friction.

Terikat di kedua-dua hujung tali masing-masing adalah dua beban berjisim 15 kg dan 5 kg. Tali dililit pada drum dengan momen inesia 0.86 kgm^2 dan diameter 920 mm. Abaikan sebarang geseran. Kirakan:

i. The acceleration of the system and both tension on the rope when the system is allowed to fall freely.

Pecutan sistem dan ketegangan tali apabila sistem dibenarkan jatuh dengan bebas.

[7 marks]
[*7 markah*]

ii. The torque of the driver if the mass of 15 kg is required to lift up with acceleration of 1.2 m/s^2.

Tork pemacu apabila beban 15 kg perlu dinaikkan dengan pecutan 1.2 m/s^2.

[6 marks]
[*6 markah*]

QUESTION 2

SOALAN 2

CLO1 C2

(a) Describe the following terms according to the Simple Harmonic Motion:
Terangkan istilah berikut berdasarkan Gerakan Harmoni Mudah :

i. Amplitude
Amplitud

[2 marks]
[*2 markah*]

ii. Frequency
Kekerapan

[2 marks]
[*2 markah*]

CLO1 C3

(b) A spring system with a body of mass 17 kg oscillates with Simple Harmonic Motion and a force of 41.65 N acting on it when the displacement is 2.1 m from the center position. If the amplitude of oscillation is 3.2 m, calculate:
Satu sistem spring dengan beban 17 kg bergetar secara Gerakan Harmoni Mudah (GHM) dan daya yang bertindak terhadap sistem itu adalah sebanyak 41.65 N apabila berlaku anjakan sejauh 2.1 m dari kedudukan keseimbangan. Jika anjakan paling jauh pada getaran ini pada 3.2 m, kirakan:

i. The frequency of such movements.
Kekerapan pergerakan getaran sistem tersebut.

[6 marks]
[*6 markah*]

ii. The velocity of the body at that time.
Halaju beban tersebut pada masa itu.

[3 marks]
[*3 markah*]

CLO1
C4

(c) A piston, connecting rod and crank mechanism is shown in Figure 2(c). The crank rotates at a constant speed of 300 rad/s counter-clockwise direction. The figure is not drawn according to scale.

Mekanisma omboh, rod penyambung dan engkol ditunjukkan dalam Rajah 2(c). Engkol berputar dengan halaju seragam 300 rad/s melawan arah jam. Rajah tidak dilukis mengikut skala.

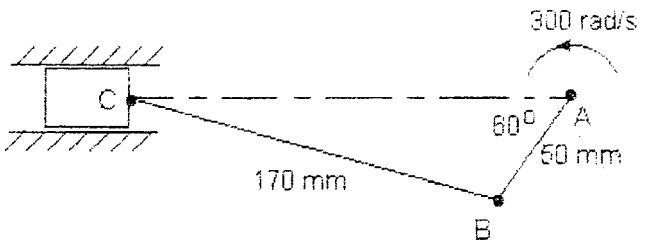

Figure 2(c) / Rajah 2(c)

i. Draw the velocity diagram with scale of 1 cm : 2 m/s.

Lukis gambarajah halaju dengan skala 1 cm : 2 m/s.

[7 marks]

[*7 markah*]

ii. Analyse the effect to the system if the angular velocity of the crank AB decreased.

Analisa kesan terhadap sistem jika halaju sudut engkol AB berkurang.

[5 markah]

[*5 marks*]

QUESTION 3

SOALAN 3

CLO1
C2

(a) A rotating shaft has four masses A, B, C and D with radius of 100 cm. The mass B is 7kg with an angle of BOC = 90° and BOD = 120° as shown in Figure 3(a). Calculate:

Sebatang aci berputar membawa 4 jisim A, B, C, dan D dengan jejari dari pusat ialah 100 cm. Jisim B ialah 7kg dengan sudut BOC = 90° dan BOD = 120° seperti dalam Rajah 3(a). Kirakan:

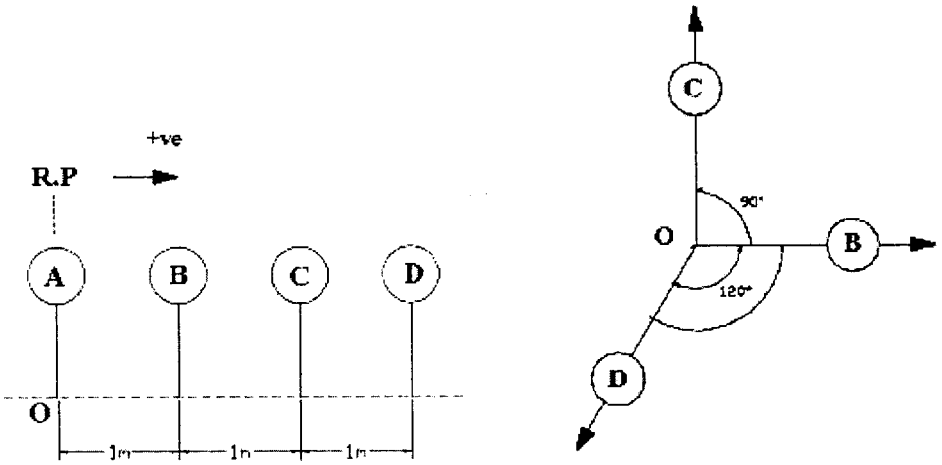

Figure 3(a) / Rajah 3(a)

i. The masses of A, C and D

Nilai jisim bagi A, C dan D

[9 marks]

[*9 markah*]

ii. The angular position of A so the system is balanced.

Kedudukan sudut A bagi menyeimbangkan sistem tersebut

[3 marks]

[*3 markah*]

CLO 1
C3

(b) A 55kg block is pulled up at 26° inclined plane by a 500N of force. If the force is inclined 19° with respect to the inclined plane, calculate:
Satu blok berjisim 55kg ditarik ke atas satu satah bercondong 26° oleh satu daya 500N. Jika daya itu bercondong 19° daripada satah condong itu, kirakan:

i) Coefficient of friction [9 marks]
Pekali geseran [*9 markah*]

ii) Angle of friction [2 marks]
Sudut geseran [*2 markah*]

iii) Minimum force to pull up the block [2 marks]
Daya minimum untuk menaikkan blok itu ke atas [*2 markah*]

QUESTION 4

SOALAN 4

CLO 1
C1

(a) List down **FIVE (5)** advantages of belt drive compared to gear system.
*Senaraikan **LIMA (5)** kelebihan penggunaan talisawat berbanding sistem gear.*

[5 marks]
[*5 markah*]

CLO 1
C2

(b) Following are the details of a crossed belt drive:
Berikut adalah maklumat talisawat silang:

Diameter of the driver	: 200mm
Garis pusat pemacu	*: 200mm*
Diameter of the follower	: 400mm
Garis pusat di pacu	*: 400mm*
Centre distance of the drive	: 2m
Jarak antara pusat takal	*: 2m*

Determine the length of the belt required.
Dapatkan panjang talisawat yang diperlukan

[5 marks]
[*5 markah*]

CLO 1
C3

(c) Two pulleys each with a diameter of 0.9 m and 0.5 m is connected at distance of 3 m by a belt weighing 0.86 kg/m. A pulley rotates at 250 rpm. It is known that coefficient of friction is 0.3 and maximum permissible load of the belt is 1.35 kN. Calculate:
Dua takal dengan setiap satunya berdiameter 0.9m dan 0.5m disambungkan berjarak 3 m oleh satu talisawat seberat 0.86kg/m. Takal ini berputar pada kelajuan 250 psm. Diketahui pekali geseran ialah 0.3 dan beban maksimum yang dibenarkan ialah 1.35 kN. Kirakan:

i) Initial tension
Tegangan mula

[8 marks]
[*8 markah*]

ii) Power transmitted
Kuasa yang dihantar

[2 marks]
[*2 markah*]

iii) Maximum power able to be transmitted
Kuasa maksimum yang boleh dihantar

[5 marks]
[*5 markah*]

SOALAN TAMAT

FORMULA DJJ5113

SIMPLE HARMONIC MOTION

$v = \omega\sqrt{A^2 - x^2}$

$a = x\omega^2$

$\Omega = \omega\sqrt{\phi^2 - \theta^2}$

$\alpha = \omega^2\theta$

$T = \frac{2\pi}{\omega}$

$f = \frac{1}{T}$

$a_{maks} = A\omega^2$

$v_{maks} = A\omega$

Mass on spring	Pendulum
$T = 2\pi\sqrt{\frac{d}{g}}$ $T = 2\pi\sqrt{\frac{m}{k}}$	$T = 2\pi\sqrt{\frac{l}{g}}$

VELOCITY AND ACCELERATION DIAGRAM

$v = \omega r$

$a_r = \omega^2 r$

$a_t = \alpha r$

FRICTION

$\mu = \frac{F}{N}$

$\tan \phi = \mu$

$P_{upward} = W \tan(\alpha + \phi)$

$P_{downward} = W \tan(\alpha - \phi)$

$P_{downward} = W \tan(\phi - \alpha)$

$P_{minimum} = mg \sin(\alpha + \phi)$

$\eta_{forward} = \tan\alpha / \tan(\alpha + \phi)$

$\eta_{reverse} = \tan(\alpha - \phi) / \tan\alpha$

$\eta_{reverse} = \tan(\phi - \alpha) / \tan\alpha$

$\eta_{maximum} = (1-\sin\phi)/(1+\sin\phi)$

HOIST

$v = r\omega$

$a = r\alpha$

$I = mk^2$

Power = $T\omega$

BALANCING

$Centrifugal\ Force = (mr)\omega^2$

$Couple = (mrl)\omega^2$

DRIVE BELT

$T_o = \frac{T_1 + T_2}{2}$

$Torque = (T_1 - T_2)r$

$T_c = mv^2$

$T_c = \frac{1}{3}T_1$

Power = $(T_1 - T_2)V$

Flat belt

$\frac{T_1}{T_2} = e^{\mu\theta}$

$\frac{T_1 - T_c}{T_2 - T_c} = e^{\mu\theta}$

Vee belt

$\frac{T_1}{T_2} = e^{\mu\theta/\sin\beta}$

$\frac{T_1 - T_c}{T_2 - T_c} = e^{\mu\theta/\sin\beta}$