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

CLO 1
C1

(a) List **FIVE (5)** types of lifting machines [5 marks]

*Senaraikan **LIMA (5)** jenis mesin angkat* [5 *markah*]

CLO 1
C2

(b) A steel drum of lifting machine has a pulley diameter of 0.87 m and 124 kgm^2 moment of inertia. A pulley was used to raise 1.9 tonnes lift with acceleration $0.8m/s^2$. Calculate the driving torque.

Sebuah mesin angkat mempunyai diameter aci gelendong 0.87 m dan momen inersia 124 kgm^2. Aci gelendung digunakan untuk menaikkan beban 1.9 tan dengan pecutan 0.8 m/s^2. Kirakan tork pemacu.

[7 marks]

[7 *markah*]

CLO 1
C3

(c) A rope was tied to a steel drum of lifting machine. The drum has a diameter of 3 m, mass of 60 kg and 0.5 radius of gyration. The lifting machine is used to lift up the load of 80 kg with an acceleration of 2.6 m/s^2. This load is balanced with a 30 kg balancing mass. Calculate:

Seutas tali dililit pada gelendung sebuah mesin angkat. Gelendung tersebut mempunyai diameter 3 m, jisim 60 kg dan 0.5 jejari kisar. Mesin angkat digunakan untuk mengangkat beban 80 kg dengan pecutan 2.6 m/s^2. Beban ini diimbangkan dengan 30 kg jisim imbang. Kirakan:

i. Tension of the ropes at lifting machine. [6 marks]

Tegangan tali pada mesin angkat. [6 *markah*]

ii. Torque drive to lift up the load of 80 kg. [5 marks]
Daya kilas untuk mengangkat beban 80 kg. [5 *markah*]

iii. Linear velocity of mass when the power produce from drum is 10 kW. [2 marks]
Halaju linear jisim apabila kuasa yang dikeluarkan oleh gelendung adalah 10 kW. [2 *markah*]

QUESTION 2
SOALAN 2

CLO 1 C2

(a) Restate the definition for the following terms according to the Simple Harmonic Motion:
Nyatakan semula definasi terma yang berikut berdasarkan kepada Gerakan Harmonik Mudah:

i. Periodic time [2 marks]
Masa berkala [2 *markah*]

ii. Frequency [2 marks]
Frekuensi [2 *markah*]

CLO 1 C3

(b) It is known that a spring with load mass of 250 g will stretch 15.0 cm. The spring is then stretched to additional 7.5 cm and then released. Calculate:
Diketahui bahawa spring dengan beban jisim 250 g akan meregang sebanyak 15.0 cm. Spring kemudian diregangkan dengan tambahan 7.5 cm dan dilepaskan. Kirakan:

i. The spring stiffness, K [2 marks]
Pemalar spring, K [2 *markah*]

ii. Frequency, f [3 marks]
Frekuensi, f [*3 markah*]

iii. The maximum acceleration [2 marks]
Pecutan maksimum [*2 markah*]

iv. The maximum velocity [2 marks]
Halaju maksimum [*2 markah*]

CLO 1
C4

(c) The Figure Q2 (c) show the crank AB rotates anti-clockwise at angular velocity, ω of 200 rad/s. For the figure shown;
Gambarajah S2 (c) menunjukkan aci engkol AB berputar arah melawan jam pada kelajuan sudut, ω = 200 rad/s. Bagi gambarajah yang ditunjukkan;

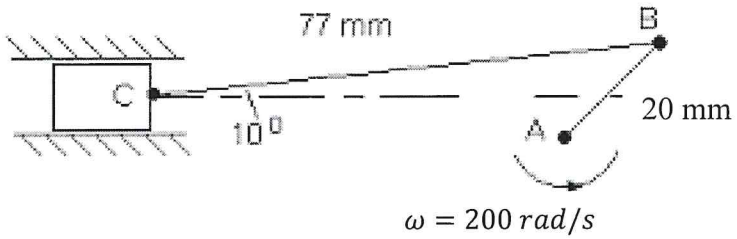

Figure Q2 (c) / *Gambarajah S2 (c)*

i. Draw the space diagram [3 marks]
Lukiskan gambarajah ruang [3 *markah*]

ii. Draw the velocity diagram [4 marks]
Lukiskan gambarajah halaju [4 *markah*]

iii. Determine the angular velocity of link BC [2 marks]
Tentukan halaju sudut penyambung BC [2 *markah*]

iv. Analyse the effect to the system if the angular velocity, ω of the crank AB increased. [3 marks]
Analisa kesan terhadap system jika halaju sudut, ω engkol AB bertambah. [*3 markah*]

QUESTION 3

SOALAN 3

CLO 1
C2

(a) Four masses A, B, C and D are 100 kg, 150 kg, 120 kg and 130 kg respectively are affixed to a shaft and rotated around the similar plane. The attached radius of rotations are 22.5 cm, 17.5 cm, 25 cm and 30 cm respectively along with the angles measured from A are 45°, 120° and 255° as shown in the **Figure Q3(a)**. Obtain the magnitude and position of the balancing mass, in case of the radius of revolving is 60 cm.

Empat jisim A, B, C dan D adalah 100 kg, 150 kg, 120 kg dan 130 kg masing-masing diletakkan pada sebatang aci yang berputar di sekitar satah yang sama. Jejari putaran pada setiap sambungan adalah 22.5 cm, 17.5 cm 25 cm dan 30 cm masing-masing beserta sudut yang diukur dari A adalah 45°, 120° and 255°seperti ditunjukkan dalam ***Gambarajah S3(a).*** *Dapatkan magnitud dan kedudukan jisim imbang, jika jejari putaran adalah 60 cm.*

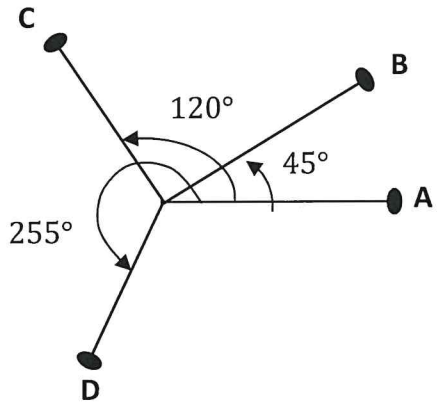

Figure Q3(a) / ***Gambarajah S3(a)***

[12 marks]

[12 *markah*]

CLO 1
C3

(b) A block with a mass of 152 kg is placed on 23° inclined plane. The block is

pulled up the slope by a force of 1.1 kN acting 18° from the inclined plane. If the block acceleration is 2.4 m/s^2; calculate:

Sebuah bongkah berjisim 152 kg diletakkan pada satah condong bersudut 23°. Bongkah tersebut ditarik mendaki cerun oleh daya 1.1 kN yang bertindak pada 18° *dari satah condong. Jika pecutan bongkah adalah 2.4 m/s^2;kirakan:*

i. Friction force [8 marks]
Daya geseran [8 *markah*]

ii. Normal reaction force to pull the block [3 marks]
Daya tindak balas normal untuk menaikkan bongkah [3 *markah*]

iii. The coefficient of friction [2 marks]
Pekali geseran [2 *markah*]

QUESTION 4

SOALAN 4

CLO 1 C1 (a) List **FIVE (5)** advantages of belt drives. [5 marks]
*Senaraikan **LIMA (5)** kelebihan tali sawat.* [5 *markah*]

CLO 1 C2 (b) Determine the length of belt that is needed to drive a pulley of 520 cm diameter that runs parallel at a distance of 14 meter from the driving pulley of 95 cm diameter. This system is an open belt drive.
Tentukan panjang talisawat yang diperlukan untuk memacu takal berdiameter 520 cm yang selari dengan takal dipacu berdiameter 95 cm dengan jarak 14 meter. Sistem ini adalah pacuan tali sawat terbuka.

[5 marks]
[5 *markah*]

CLO 1
C3

(c) A close belt drive connects two pulleys of 380 mm and 245 mm of diameter and the distance between two pulleys is 2.6 m. The larger pulley rotates at 250 rev/min and the maximum tension in it is not exceed 1.4 kN. Coefficient of friction between belt and pulley is 0.3. Calculate:

Sebuah tali sawat tertutup menghubungkan dua takal berdiameter 380 mm dan 245 mm dengan jarak antara kedua-dua takal adalah 2.6 m. Takal yang lebih besar berputar pada 250 psm dan ketegangan maksimum tidak melebihi 1.4 kN. Pekali geseran antara tali sawat dan takal ialah 0.3. Hitungkan:

i. Angle of contact between the belt and each pulley. [5 marks]
Sudut sentuhan antara tali sawat dan takal. [5 *markah*]

ii. Length of the belt. [3 marks]
Panjang tali sawat [3 *markah*]

iii. Power transmitted by the belt. [7 marks]
Kuasa yang dihantar oleh tali sawat. [7 *markah*]

SOALAN TAMAT

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

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

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