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) List **FIVE (5)** types of lifting machines.

*Senaraikan **LIMA (5)** jenis mesin angkat.* [5 marks]

[*5 markah*]

CLO1 C2 (b) (i) Explain the term 'driver torque', T_d in the hoisting machine.

Terangkan tentang istilah 'tork pemacu', T_d, dalam mesin angkat.

[3 marks]

[*3 markah*]

(ii) Express the equation for linear motion and angular motion for the hoisting system in Figure 1(b).

Tunjukkan persamaan bagi gerakan lurus dan gerakan sudut untuk sistem mesin angkat dalam Rajah 1(b).

[4 marks]

[*4 markah*]

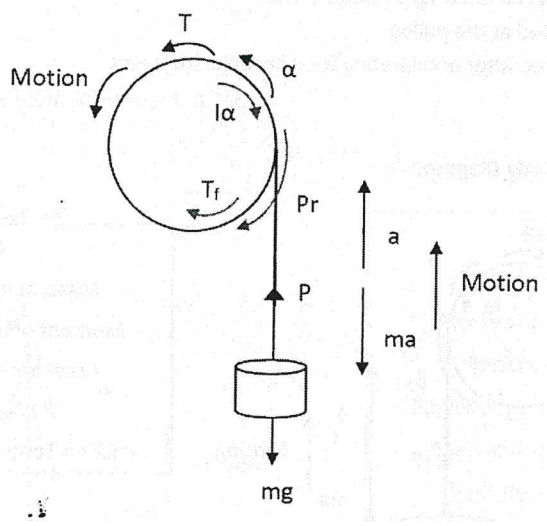

Figure 1(b)/ *Rajah 1(b)*:

The load raised with acceleration/ *Beban dinaikkan dengan pecutan*

CLO1
C3

(c) A load with a mass of 150 kg is lifted by means of a rope which is wound several times around a drum and is then supported by a balancing mass of 80 kg as shown in **Figure 1(c)**. As the load rises, the balancing mass falls. The drum has a diameter of 1.2 m, a radius of gyration of 480 mm and weight 70 kg. Calculate the driving torque and also the power required at an instant when the load has an upward velocity of 2.5 m/s and upward acceleration of 1.2 m/s^2.

Satu beban seberat 150 kg *diangkat dengan menggunakan tali ringan yang dililit pada satu gelendong dengan diimbangi oleh jisim imbang seberat 80* kg *seperti* ***Rajah 1(c)***. *Apabila beban diangkat, jisim imbang akan ke bawah. Diameter gelendong adalah 1.2* m, *jejari kisar adalah 480* mm *dan berat gelendong adalah 70* kg. *Kirakan tork pemacu dan juga kuasa yang diperlukan apabila beban naik dengan halaju 2.5* m/s *dan pecutan 1.2* m/s^2.

[13 marks]

[*13 markah*]

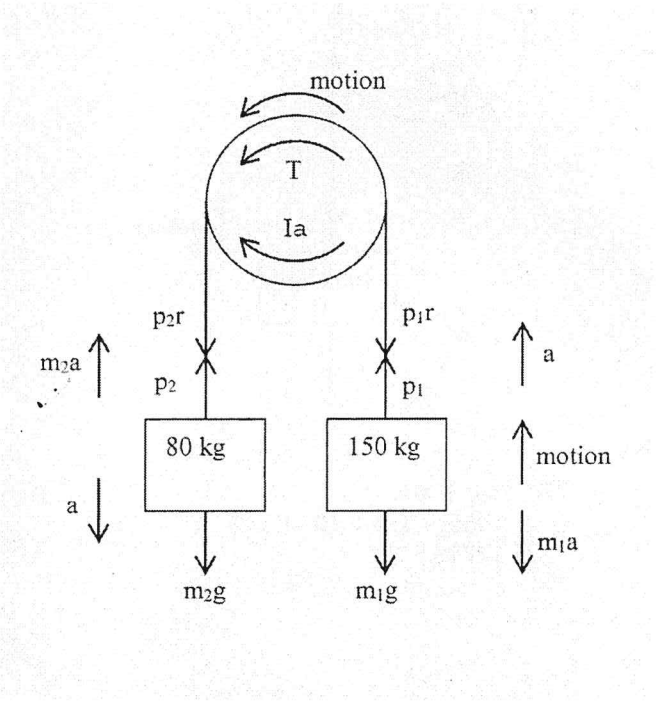

Figure 1(c) / *Rajah 1(c)*

QUESTION 2

SOALAN 2

CLO1
C2

(a) Simple Harmonic Motion (SHM) stated that equation for maximum acceleration and maximum velocity as shown below. Interpret what is '*A*' and 'ω'.

Gerakan Harmoni Mudah (GHM) telah menetapkan bahawa persamaan untuk pecutan maksima dan halaju maksima adalah seperti di bawah. Tafsirkan apakah 'A' and 'ω'.

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

$$v_{maks} = A\omega \ .$$

[4 marks]

[*4 markah*]

CLO1
C3

(b) A body oscillated with simple harmonic motion with amplitude of 730 mm. If the frequency of oscillation is 0.5 Hz, calculate:

Satu jasad berayun dengan gerakan harmoni mudah mempunyai amplitude 730 mm. *Jika kekerapan ayunan adalah 0.5* Hz, *kirakan:*

(i) Maximum linear velocity
Halaju linear maksima

[6 marks]
[*6 markah*]

(ii) Maximum linear acceleration.
Pecutan linear maksima.

[3 marks]
[*3 markah*]

CLO1
C4

(c) A piston, connecting rod and crank mechanism is shown in **Figure 2(c)**. The crank AB with a radius of 70 mm rotates counter-clockwise at a constant velocity of 200 rad/s.

Mekanisma bagi sebuah amboh, sebatang rod penyambung dan sebuah engkol adalah seperti ***Rajah 2(c)***. *Engkol* AB *yang berjejari 70* mm *memutar mengikut arah lawan jam pada halaju seragam 200* rad/s.

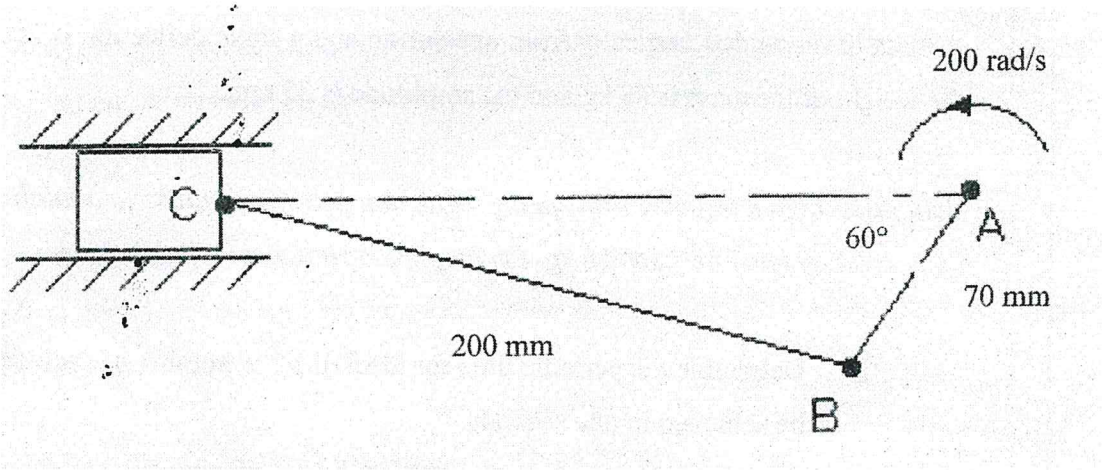

Figure 2(c) / Rajah 2(c)

(i) Illustrate the space diagram using the scale of 1 cm : 20 mm.
Ilustrasikan gambarajah ruang dengan menggunakan skala 1 cm : 20 mm.

[2 marks]
[*2 markah*]

(ii) Illustrate the velocity diagram the scale scale of 1 cm : 2 m/s.
Ilustrasikan gambarajah halaju dengan menggunakan skala 1 cm : 2 m/s

[5 marks]
[*5 markah*]

(iii) Analyze the effect to the system if the angular velocity, ω of the crank AB increase.
Analisis kesan kepada sistem jika halaju sudut, ω engkol AB *meningkat.*

[5 marks]
[*5 markah*]

QUESTION 3
SOALAN 3

CLO1 C2

(a) A round disc attached on a shaft holds three masses 4kg, 3kg and 2.5kg at radial distance 75mm, 85mm and 50mm with the respective angular location of 45°, 135° and 240°. These angular positions are measured counter-clockwise from the reference line alongside x-axis. A mass X is installed to balance the system at radius of 75 mm.

Satu cakera bulat yang dipasang pada aci mempunyai tiga jisim 4kg, 3kg *dan* 2.5kg *pada jejari* 75mm, 85mm *dan* 50mm *dengan kedudukan sudut masing-masing 45°, 135° dan 240°. Kedudukan sudut ini diukur melawan arah jam*

dari garis rujukan sepanjang paksi-x. Satu beban X dipasang untuk menyeimbangkan sistem tersebut dengan jejari 75 mm.

(i) Complete the Table Q3(a) below using the data given:
Lengkapkan Jadual S3(a) dibawah dari data yang diberi,:

Plane	Mass, m (kg)	Radius, r (m)	Centrifugal Force, mr (kg.m)
A			
B			
C			
X			

[4 marks]
[*4 markah*]

(ii) Convert the table into space diagram (angular position) & mr Polygon.
Tukarkan jadual kepada gambarajah ruang (kedudukan sudut) dan poligon mr.

[6 marks]
[*6 markah*]

(iii) Locate the balancing mass and angular position of X.
Cari jisim beban pengimbang dan kedudukan sudut X.

[2 marks]
[*2 markah*]

CLO1 C3 (b) A 6 kg object is placed on a 10° incline plane. A 35 N force acts on the object in the parallel direction and pulls up on inclined plane.
Satu objek berjisim 6 kg *telah diletakkan pada satah condong 10°. Satu daya 35* N *dikenakan pada objek dalam arah selari dan ditarik keatas satah condong.*

(i) Sketch a free body diagram
Lakarkan gambarajah badan bebas

[3 marks]
[*3 markah*]

(ii) Calculate the coefficient of friction of contact surface.
Kirakan pekali geseran pada permuakaan bersentuhan.

[7 marks]
[*7 markah*]

(iii) Calculate the minimum force to pull up the object
Kirakan daya minimum untuk menaikkan objek itu.

[3 marks]
[*3 markah*]

QUESTION 4
SOALAN 4

CLO1
C1

(a) List **FIVE (5)** important factors in selecting a belt drive.
*Senaraikan **LIMA (5)** faktor penting dalam pemilihan talisawat.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Explain the following belt drive system:
Terangkan sistem talisawat berikut:

(i) Open belt drive
Talisawat terbuka

(ii) Cross belt drive
Talisawat silang

[5 marks]
[*5 markah*]

CLO1
C3

(c) An open belt drive connects with two pulleys 2.4 m and 1 m of diameter on parallel distance 4 m apart. The mass of the belt is 0.9 kg/m and maximum tension should not exceed 2500 N. The coefficient of friction is 0.3. The small pulley, which is the driver runs at 400 rpm. Calculate:

Satu talisawat terbuka disambung dengan dua takal berdiameter 2.4 m *dan 1*m *dan jarak antaranya ialah 4* m. *Jisim talisawat itu ialah 0.9* kg/m *dan tegangan maksimum tidak melebihi 2500* N. *Pekali geserannya ialah 0.3. Takal kecil memacu pada 400* psm. *Kirakan:*

(i) Centrifugal tension
Tegangan empar

[4 marks]
[*4 markah*]

(ii) Power transmitted
Kuasa yang dipindahkan

[7 marks]
[*7 markah*]

(iii) Torque on each pulley
Daya kilas pada setiap takal

[4 marks]
[*4 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

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

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