SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI I : 2022 / 2023

DJJ30093: ENGINEERING MECHANICS

TARIKH : 15 DISEMBER 2022
MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

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) Define the terms bellows :

Takrifkan istilah di bawah :

i. Static

Statik

[2 marks]

[*2 markah*]

ii. Dynamic

Dinamik

[2 marks]

[*2 markah*]

CLO1 C3 (b) Based on Figure 1(b), if $F_2 = 30$ kN and $\theta = 55^o$;

Berdasarkan Rajah 1(b), jika $F_2 = 30$ kN dan $\theta = 55^o$;

i. Calculate each force into Component-x (Fx) and Component-y (Fy).

Kirakan setiap daya kepada Komponen-x (Fx) dan Komponen-y (Fy).

[6 marks]

[*6 markah*]

ii. Calculate the magnitude of the resultant force in Cartesian Vector Form.

Kirakan magnitud daya paduan dalam Bentuk Vektor Kartesian.

[2 marks]

[*2 markah*]

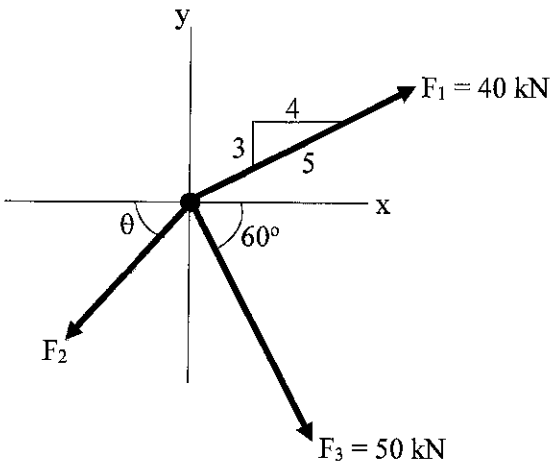


Figure 1(b) / *Rajah 1(b)*

CLO1 C2 (c) Explain the condition for Equilibrium of Particle.
Terangkan keadaan bagi Keseimbangan Zarah.

[3 marks]
[*3 markah*]

CLO1 C3 (d) Figure 1(d) shows a plane force system acting at O. Calculate the magnitude of the forces F_1 and F_2 if the system is in equilibrium.
Rajah 1(d) menunjukkan satu sistem daya sesatah yang bertindak pada O. Kirakan magnitud daya F_1 dan F_2 sekiranya sistem tersebut berada dalam kesimbangan.

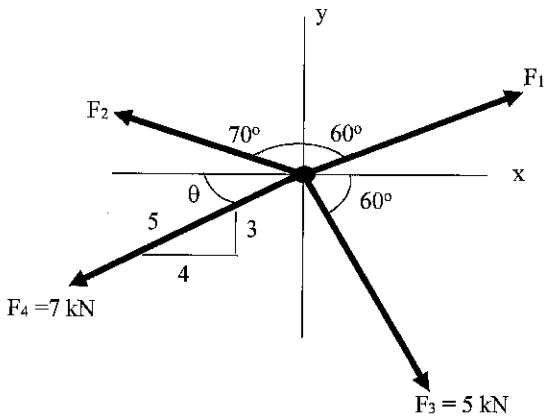


Figure 1(d) / *Rajah 1(d)*

[10 marks]
[*10 markah*]

QUESTION 2

SOALAN 2

CLO2 C4

(a) The truss is subjected to the loading as shown in Figure 2.

Struktur berikut dikenakan daya seperti yang ditunjukkan dalam Rajah 2.

i. Find the value of θ_1 and θ_2 for the truss in Figure 2.

Cari nilai θ_1 *dan* θ_2 *bagi tetulang pada Rajah 2.*

[2 marks]

[*2 markah*]

ii. Illustrate free body diagram and lebel all the force acting for the truss in Figure 2.

Gambarkan rajah jasad bebas dan tandakan semua daya yang bertindak pada tetulang pada Rajah 2.

[3 marks]

[*3 markah*]

iii. Find the reaction force at supporter A and C in Figure 2.

Cari daya tindakbalas pada penyokong A dan C pada Rajah 2.

[6 marks]

[*6 markah*]

CLO2 C4

(b) Determine the force in all members and indicate if the member is in tension or compression.

Tentukan daya dalam semua ahli dan nyatakan samada ia berada dalam keadaan tegangan atau mampatan.

i. Member BD.

Ahli BD.

[1 mark]

[*1 markah*]

ii. Member AD and AB.
Ahli AD dan AB.

[5 marks]
[*5 markah*]

iii. Member BC, BD and DC.
Ahli BC, BD dan DC.

[8 marks]
[*8 markah*]

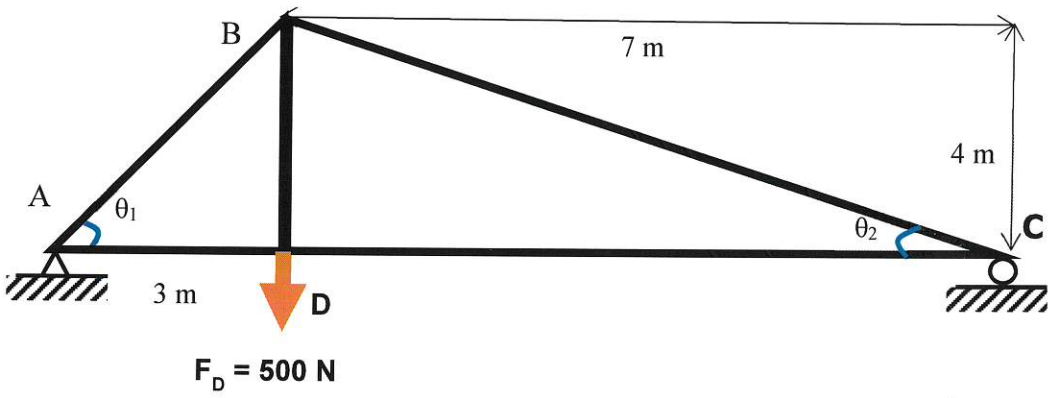


Figure 2 / *Rajah 2*

QUESTION 3
SOALAN 3

CLO1 C1 (a) Define the following terms :
Takrifkan istilah berikut :

i. Velocity.
Halaju.

[2 marks]
[*2 markah*]

ii. Speed.
Laju.

[2 marks]
[*2 markah*]

CLO1 C2 (b) Visualize using suitable velocity-time graph.
Gambarkan menggunakan graf halaju-masa yang sesuai.

i. When the object start from rest.
Apabila objek bernula dari keadaan diam.

[2 marks]
[*2 markah*]

ii. When the object is in acceleration.
Apabila objek dalam keadaan pecutan.

[2 marks]
[*2 markah*]

iii. When the object is in deceleration.
Apabila object dalam keadaan nyah pecutan.

[2 marks]
[*2 markah*]

iv. When the object is in uniform motion.
Apabila objek dalam keadaan gerakan seragam.

[2 marks]
[*2 markah*]

CLO1 C3 (c) A car starts from rest and accelerates uniformly for 20 seconds until it reaches 22 m/s at the end of acceleration. Then the car moves constantly for 40 seconds, after that it accelerates for 10 seconds until it reaches 28 m/s and then stops in 30 seconds.
Sebuah kereta bermula dari diam dan kemudian memecut selama 20 saat sehingga mencapai 22 m/s pada akhir pecutannya. Kemudian kereta tersebut

bergerak secara seragam untuk selama 40 saat, selepas itu ia memecut untuk kali kedua selama 10 saat sehingga mencapai 28 m/s dan kemudian berhenti dalam masa 30 saat.

i. Draw a velocity-time graph for this trip.
Lukiskan graf halaju-masa bagi perjalanan tersebut.

[4 marks]
[*4 markah*]

ii. Calculate the second acceleration.
Kirakan pecutan kali ke-2.

[3 marks]
[*3 markah*]

iii. Calculate each of distance travelled by the car during first acceleration, uniform velocity and deceleration.
Kirakan setiap jarak yang dilalui oleh kereta tersebut semasa mula-mula memecut,semasa halaju seragam dan semasa lambatan.

[6 marks]
[*6 markah*]

QUESTION 4
SOALAN 4

CLO1 C1 (a) Define Newton Second Law of Motion.
Definisikan Hukum Gerakan Newton Kedua.

[4 marks]
[4 *markah*]

CLO1 C2 (b) A particle of 2 kg mass is being pulled across a smooth horizontal surface by a horizontal force. The force does 24 Joule of work in increasing the particle's velocity from $5ms^{-1}$ to v ms^{-1}. Express :

Satu zarah berjisim 2 kg sedang ditarik pada permukaan mendatar dengan daya mendatar. Daya itu menghasilkan kerja sebanyak 24 Joule dan menyebabkan peningkatan halaju zarah dari 5ms^{-1} ke v ms^{-1}. Nyatakan;

i. The value of v after 15 seconds.
Nilai bagi v selepas 15 saat.

[5 marks]
[5 *markah*]

ii. The value of the position for the particle after 15 seconds.
Nilai kedudukan zarah selepas 15 saat.

[3 marks]
[*3 markah*]

CLO1
C3

(c) The 50 kg crate in Figure 4(c) rests on a horizontal surface for which the coefficient of kinetic friction is $\mu_k = 0.3$. If the crate is subjected to a 400 N towing force as shown, calculate;
Satu kotak dengan berat 50 kg seperti Rajah 4(c) terletak pada permukaan mengufuk dengan pekali geseran kinetik ialah $\mu_k = 0.3$. Jika kotak itu dikenakan satu daya tunda 400 N seperti ditunjukkan, kirakan;

i. The value of normal force and the friction force.
Nilai daya normal dan daya geseran.

[6 marks]
[*6 markah*]

ii. The value of an acceleration of the crate.
Nilai pecutan bagi kotak tersebut.

[4 marks]
[*4 markah*]

iii. The velocity of the crate after 3 seconds starting from rest.

Halaju bagi kotak selepas 3 saat dari pegun.

[3 marks]

[*3 markah*]

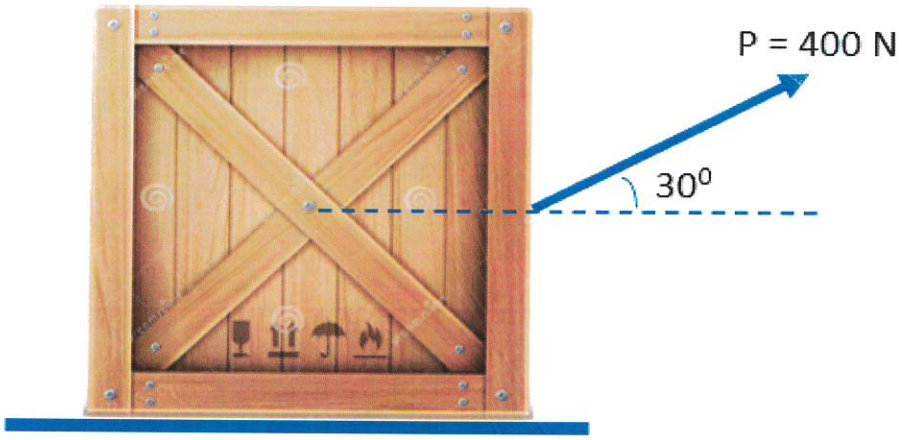


Figure 4(c) / Rajah 4(c)

SOALAN TAMAT

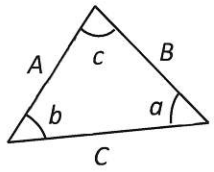
POLITEKNIK MALAYSIA

LIST OF FOMULA

DJJ30093 ENGINEERING MECHANICS

STATICS

1. TRIANGLE RULE



Sine law:

$$\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c}$$

Cosine law:

$$C = \sqrt{A^2 + B^2 - 2AB\cos c}$$

2. ADDITION OF SYSTEM OF COPLANAR FORCE

$$\left(\overset{+}{\rightarrow}\right)\ \Sigma F_x = F_{1x} + F_{2x} - F_{3x}$$

$$(+\uparrow)\ \Sigma F_y = F_{1y} - F_{2y} + F_{3y}$$

$$F_R = \sqrt{(\Sigma F_x)^2 + \left(\Sigma F_y\right)^2}$$

$$\theta = \tan^{-1}\left(\frac{\Sigma F_y}{\Sigma F_x}\right)$$

3. CARTESIAN VECTOR

$$\mathbf{F} = F_x\mathbf{i} + F_y\mathbf{j} + F_z\mathbf{k}$$

$$\mathbf{u}_A = \frac{\mathbf{F}}{F} = \frac{F_x}{F}\mathbf{i} + \frac{F_y}{F}\mathbf{j} + \frac{F_z}{F}\mathbf{k}$$

$$cos^2\alpha + cos^2\beta + cos^2\gamma = 1$$

$$\mathbf{F_R} = \mathbf{\Sigma F} = \Sigma F_x\mathbf{i} + \Sigma F_y\mathbf{j} + \Sigma F_z\mathbf{k}$$

$$\mathbf{r} = (x_B - x_A)\,\mathbf{i} + (y_B - y_A)\mathbf{j} + (z_B - z_A)\mathbf{k}$$

$$\mathbf{F} = F\mathbf{u} = F\frac{\mathbf{r}}{r}$$

4. EQUILIBRIUM OF PARTICLE

$$\mathbf{\Sigma F} = 0$$

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

$$v = \frac{ds}{dt}$$

$$a = \frac{dv}{dt}$$

$$a\,ds = v\,dv$$

2. UNIFORM RECTILINEAR MOTION

- *a constant*:

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{1}{2}(v + u)t$$

$$v = r\omega$$

$$a = r\alpha$$

3. WORK OF FORCE

$$U_{1-2} = (F\cos\alpha)\Delta s$$

4. KINETIC ENERGY OF PARTICLE

$$KE = \frac{1}{2}mv^2$$

$$U_{1-2} = T_2 - T_1$$

5. POTENTAL ENERGY

$$PE = mgh$$