SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI I : 2023/2024

DJJ30093: ENGINEERING MECHANICS

TARIKH : 17 DISEMBER 2023
MASA : 8.30 PG – 10.30 PG (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. Answers **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) Define the Newton's first law of motion and give **TWO (2)** examples of the Newton's first law of motion.

*Berikan definisi hukum pergerakan pertama Newton dan berikan **DUA (2)** contoh bagi hukum pergerakan pertama Newton tersebut.*

[4 marks]

[4 *markah*]

CLO1 (b) Refer to Figure 1(b), calculate;

Merujuk kepada Rajah 1(b), kirakan;

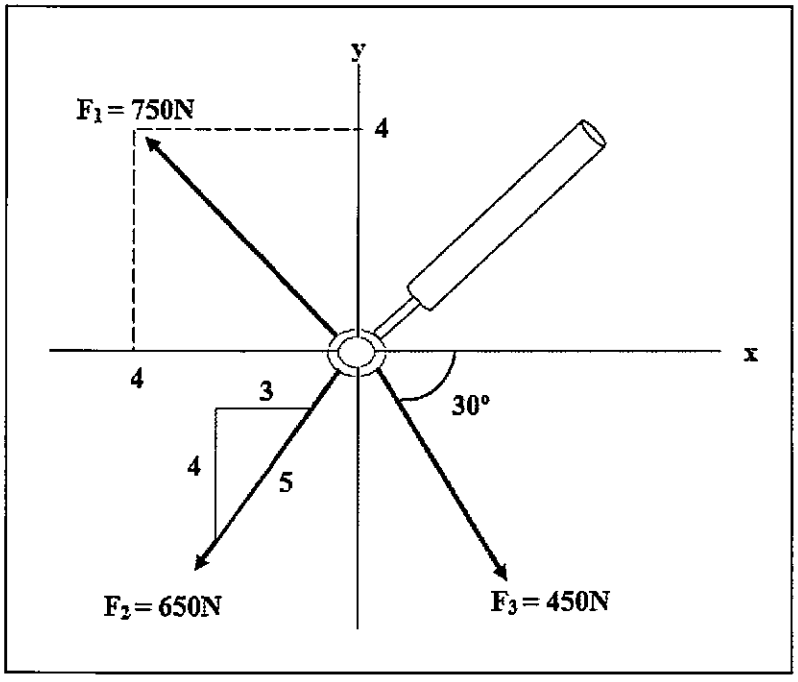


Figure 1b / *Rajah 1b*

i. Force in component x and y axis and resultant force in terms of cartesian vector.
Komponen daya paksi x dan y dan daya paduan dalam bentuk vektor cartesian.

[6 marks]
[*6markah*]

ii. Magnitude of the resultant force, F_r.
Magnitud daya paduan, F_r.

[2 marks]
[*2markah*]

CLO1 (c) i. Explain the equilibrium equation using the Newton's Second law of motion.
Terangkan persamaan keseimbangan menggunakan Hukum Pergerakan Newton Kedua.

[3 marks]
[*3 markah*]

CLO1 ii. Express the value of the internal forces in cable CB, CE and spring CD in Figure 1(c), if the mass of the ball is 73kg.
Nyatakan nilai bagi daya dalaman bagi kabel CB, CE dan pegas CD dalam Rajah 1(c), jika jisim bola 73kg.

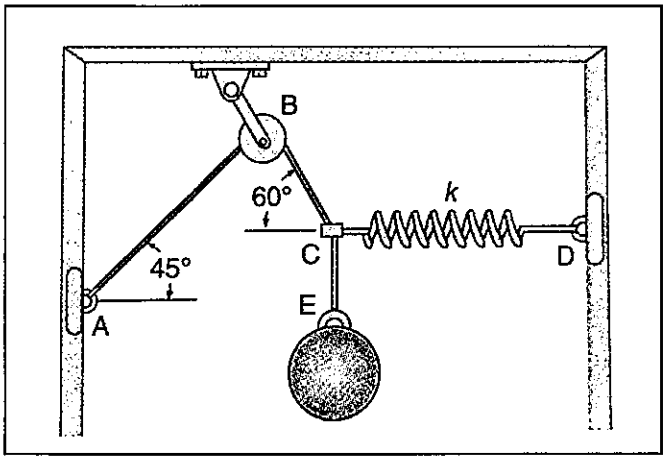


Figure 1c / *Rajah 1c*

[10 marks]
[10 *markah*]

QUESTION 2

SOALAN 2

CLO2

(a) The truss is subjected to the loading as shown in **Figure 2a**;
Struktur berikut dikenakan daya seperti yang ditunjukkan dalam ***Rajah 2a;***

i. Draw the free body diagram for the truss as shown in **Figure 2a**.
Lukiskan gambarajah badan bebas untuk struktur seperti yang ditunjukkan dalam ***Rajah 2a.***

[2 marks]
[*2 markah*]

ii. Calculate the reaction force for each supporter.
Kirakan daya tindak balas bagi setiap penyokong.

[3 marks]
[*3 markah*]

iii. Calculate the force in each member by using the method of joint and state the members are in tension or compression.
Kirakan daya dalam setiap anggota struktur dengan menggunakan kaedah sambungan dan nyatakan anggota berada dalam keadaan tegangan atau mampatan.

[6 marks]
[*6 markah*]

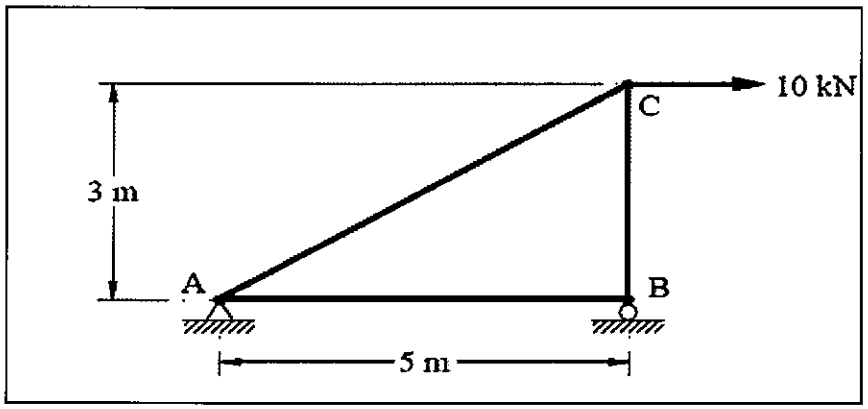


Figure 2a / *Rajah 2a*

CLO2

(b) **Figure 2b** shows a truss on the floor with a supporter pin at A and supporter a roller at D. By using the method of section;

Rajah 2b *menunjukkan struktur berada di atas lantai dengan penyokong pin pada A dan penyokong penggelek pada D. Dengan menggunakan kaedah keratan;*

i. Illustrate the free body diagram.
Lakarkan gambarajah badan bebas berikut.

[1 mark]
[*1 markah*]

ii. Find the reaction force at supporter A and D.
Cari daya tindak balas pada penyokong A dan E.

[5 marks]
[*5 markah*]

iii. Determine force in member BC, GF and GC of the truss and state whether the members are in tension or compression.
Tentukan daya pada anggota BC, GF dan GC dan nyatakan samada anggota struktur berada dalam keadaan tegangan atau mampatan.

[8 marks]
[*8 markah*]

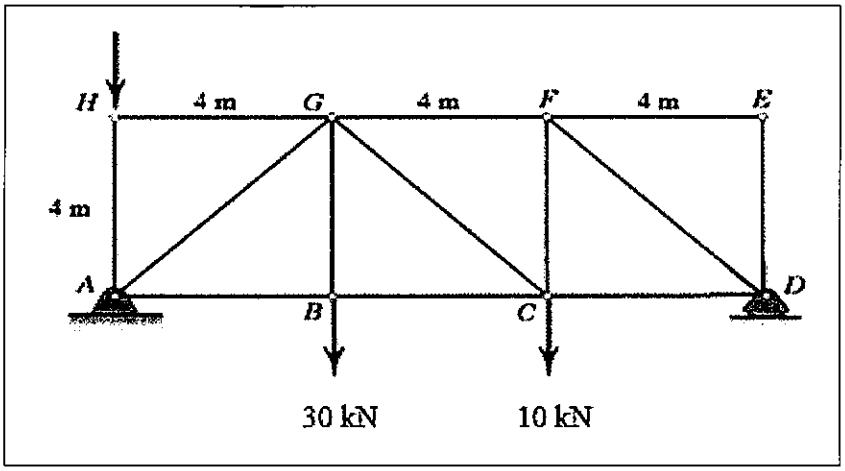


Figure 2b / *Rajah 2b*

QUESTION 3
SOALAN 3

CLO1

(a) State the following terms;
Nyatakan istilah berikut;

i. Displacement of particle
Anjakan sesuatu zarah

[2 marks]
[*2 markah*]

ii. Acceleration
Pecutan.

[2 marks]
[*2 markah*]

CLO1

(b) A motorcycle moves with a wheel speed of 250 rpm. If the diameter of motorcycle wheel is 60.5 cm ;

Sebuah motosikal bergerak dengan kelajuan roda 250 ppm. Jika diameter roda motosikal ialah 60.5 cm ;

i. Convert the velocity of motorcycle in km/h unit.

Tukarkan halaju motosikal dalam unit km/j.

[6 marks]

[6 *markah*]

ii. If the motorcycle moves for 8 minutes from rest, express the value of acceleration for the motorcycle in m/s^2

Jika motosikal tersebut bergerak selama 8 minit dari keadaan rehat, nyatakan nilai pecutan motosikal teresbut dalam m/s^2.

[2 marks]

[2 *markah*]

CLO1

(c) The distance between building A and building B is 5.8 km. A car starts from rest at building A with a constant acceleration for 32 seconds, then a car travels with a constant velocity before it decelerates constantly and stops at building B in the last 15 seconds of the journey. If the total time taken is 7 minutes:

Jarak antara bangunan A dan bangunan B adalah 5.8 km. Sebuah kereta bermula dari pegun dari bangunan A dengan pecutan seragam selama 32 saat, kemudian kereta tersebut bergerak dengan halaju seragam sebelum mengawapecut dengan seragam dan berhenti di bangunan B dalam masa 15 saat terakhir perjalanan tersebut. Jika jumlah masa yang diambil adalah 7 minit

i. Draw a velocity-time graph.

Lukiskan gambarajah graf halaju- masa

[3 marks]

[*3 markah*]

ii. Calculate the constant velocity of the car in m/s.
Kirakan halaju seragam kereta tersebut dalam m/s.

[5 marks]
[*5 markah*]

iii. Calculate the acceleration of the car in m/s^2.
Kirakan pecutan kereta tersebut dalam m/s^2.

[2 marks]
[*2 markah*]

iv. Calculate the distance traveled in the first 3 minutes of the journey.
Kirakan jarak dilalui dalam 3 minit pertama perjalanan itu.

[3 marks]
[*3 markah*]

QUESTION 4
SOALAN 4

CLO1 (a) State the following terms;
Nyatakan istilah berikut;

i. Kinetic
Kinetik

[2 marks]
[*2 markah*]

ii. Work
Kerja

[2 marks]
[*2 markah*]

CLO1

(b) An object of mass 5 kg is dropped from a height of 25 m from a building. Based on the situation below, express the value of :

Satu objek yang berjisim 5 kg telah jatuh dari ketinggian 25 m dari sebuah bangunan. Berdasarkan situasi di bawah, nyatakan nilai bagi :

i. The potential energy possessed by the object before it fell

Tenaga keupayaan yang dimiliki oleh objek sebelum ia jatuh

[2 marks]

[*2 markah*]

ii. The kinetic energy possessed by the object before it fell

Tenaga kinetik yang dimiliki oleh objek sebelum ia jatuh

[2 marks]

[*2 markah*]

iii. The potential energy possessed by the object after it fell and touched the ground

Tenaga keupayaan yang dimiliki oleh objek selepas ia jatuh dan menyentuh lantai

[2 marks]

[*2 markah*]

iv. The kinetic energy possessed by the object after it fell and touched the ground

Tenaga kinetik yang dimiliki oleh objek selepas ia jatuh dan menyentuh lantai

[2 marks]

[*2 markah*]

CLO1

(c) The 75kg crate shown 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 500N towing force as below;

Sebuah bongkah kayu 75 kg seperti Rajah 4(c) dalam keadaan rehat pada permukaan mendatar yang mempunyai koefisien pekali geseran iaitu $\mu_k = 0.3$. Jika bongkah kayu seberat 500 N itu ditarik seperti rajah di bawah;

i) Draw a Free Body Diagram (FBD)
Lukiskan gambarajah badan bebas

[4 marks]
[*4 markah*]

ii) Calculate the velocity of the crate after 5 second starting from rest.
Kirakan halaju bongkah kayu selepas 5 saat bermula dalam keadaan rehat.

[9 marks]
[*9 markah*]

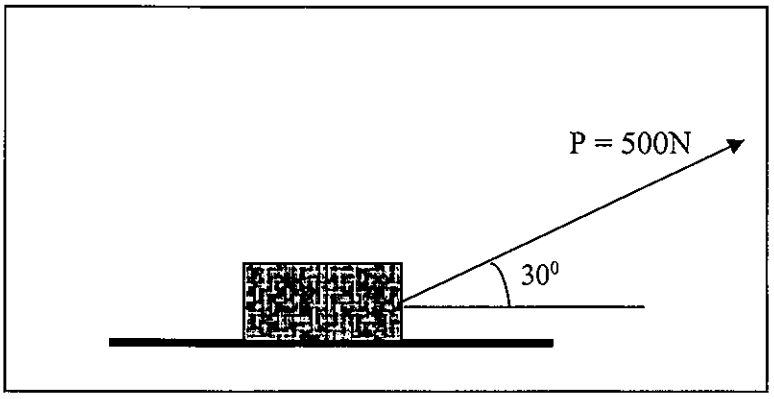


Figure 4c / *Rajah 4c*

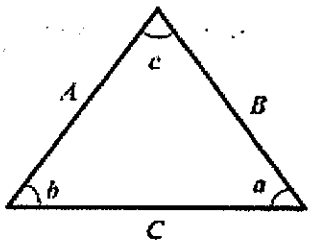
SOALAN TAMAT

POLITEKNIK MALAYSIA

LIST OF FORMULA
DJJ 30093 – 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

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

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

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

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

3. CARTESIAN VECTOR

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

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

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

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

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

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

4. EQUILIBRIUM OF PARTICLE

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

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

$$v = {ds}/{dt}$$

$$a = {dv}/{dt}$$

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

$$U_{1\rightarrow 2} = (F\cos\alpha)\Delta x$$

4. KINETIC ENERGY OF PARTICLE

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

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

5. POTENTIAL ENERGY

$$PE = mgh$$